МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ХАРКІВСЬКА НАЦІОНАЛЬНА АКАДЕМІЯ МІСЬКОГО ГОСПОДАРСТВА

# МЕТОДИЧНІ ВКАЗІВКИ
# ДЛЯ ПРАКТИЧНИХ ЗАНЯТЬ З ДИСЦИПЛИНИ “ІНОЗЕМНА МОВА”
# (АНГЛІЙСЬКА МОВА)

(для студентів 1-2 курсів денної форми навчання освітньо-кваліфікаційного рівня бакалавр напряму підготовки 6.060301 - “Гідротехніка (Водні ресурси)” спеціальності “Водопостачання та водовідведення”

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Методичні вказівки для практичних занять з дисципліни “Іноземна мова” (англійська мова) (для студентів 1-2 курсів денної форми навчання освітньо-кваліфікаційного рівня бакалавр напряму підготовки 6.060301 - “Гідротехніка (Водні ресурси)” спеціальності “Водопостачання та водовідведення” / Харк. нац. акад. міськ. госп-ва; уклад.: О. О. Костенко– Х.: ХНАМГ, 2010 – 87 с.

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Методичні вказівки для практичних занять призначенні для студентів денної форми навчання, які в майбутньому працюватимуть у сфері водопостачання та водовідведення. Головною метою їх є формування навичок читання і розуміння інформації з автентичних англомовних джерел та засвоєння необхідного обсягу лексичного матеріалу, що відповідає вимогам професійно-орієнтованого навчання іноземній мови. Зміст завдань відповідає вимогам навчальних програм, а тематика текстів сприяє розширенню обсягу сучасної англійської науково-технічної лексики. Запропонована інформація необхідна для ефективного виконання професійних обов’язків майбутніх спеціалістів.

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# INTRODUCTION

These educational materials are designed for the ESP students of the 1st and 2nd years of studies of the speciality "Water Supply and Distribution" to develop their knowledge and skills in technical English according to their profession.

This manual is based on the authentic texts from different sources concerning water supply and distribution problems. It contains the tasks for reading and translation, speaking, writing, vocabulary tasks, texts and tasks for summurising. The manual consists of 7 units and is expected to be covered during practical classes.

Each unit contains:

- pre-reading activity (questions and tasks)
- an authentic text for reading, translation and discussion in class;
- comprehension exercises;
- exercises for memorization and mastering key vocabulary;
- texts for summurising

# CONTENT:

# UNIT 1

# WATER AND ITS CHARACTERISTICS

***Before reading the text try to answer the following questions:***

1. What do you think about the role of water in supporting the most part of living things on the Earth?
2. Could you imagine the Earth without water even for a week? Describe the changes happening to it.
3. Try to give the characteristics of water.

## Water and Its Characteristics. Water Resources

Water is everywhere. It covers over three fourths of the Earth's surface, lies underground, and is present in the air that surrounds the earth.

Water supports all forms of life-plants, animals, and humankind. Some very simple forms of life can exist without air. But no form of life can exist without water. Two thirds of the human body is made of water.

Water shapes and reshapes the crust of the earth. Water plays an important role in determining climate, in weathering rock and forming soil, and in making other natural resources usable. Weather does all these things because it has special qualities that few other materials on the earth have. These special qualities make water a wonder on the earth. Water is present on the earth not only as liquid but also as gas and solid.

One of the most important qualities is its ability to store huge amounts of heat energy from the sun. Besides water releases heat even as it freezes, it helps to keep air temperatures from getting too cold too fast.

Water dissolves materials. Many minerals and other materials that come in contact with water dissolve in it. Plants and animals need these materials to grow and to build healthy bodies. So do humans. All living things take in dissolved materials when they soak up or drink water. And the water that humans and animals drink helps them to digest the foods they eat.

Oceans, seas, and other bodies of water cover 70 percent of the earth's surface. They interact with the atmosphere, affect world climates, influences world trade

routes, provides a source of energy and contains a wealth of mineral and fish resources. In recent years “ownership “of the ocean has become an increasingly important question as nations argue about the rights to use its resources.

The ocean floor contains a variety of mineral resources. Some valuable minerals simply lie on the ocean floor.

Scientists believe that the ocean’s mineral resources could supplement the decreasing reserves of nonrenewable resources on land. At the same time all agree that the ocean’s wealth must be conserved so that it can be used by future generations.

Ocean water contains traces of all the minerals found on land. These minerals, which exist in the water in the form of salts, account for seawater’s salinity, or salt content. If all the water in the world ocean were dried up, the salts would form a layer on the ocean floor 152 meters thick.

The ocean world makes up the largest biological environment of our planet. Marine biologists continually discover new species of life as changing technology allows them to probe deeper and deeper into the world ocean.

Fishing ranks among the world’s most important economic activities. Over 5 million people make their livings by fishing. And even more people process, package, and sell fish. The total fish catch each year is enough to supply about 18 kg of fish for each person in the world.

Water resources are sources of water that are useful or potentially useful to humans. Uses of water include agricultural, industrial, household, recreational and environmental activities.

97% of water on the Earth is salt water, leaving only 3% as fresh water of which slightly over two thirds is frozen in glaciers and polar ice caps.

Fresh water is a renewable resource, yet the world's supply of clean, fresh water is steadily decreasing. Water demand already exceeds supply in many parts of the world and as the world population continues to rise, so too does the water demand.

***1. Complete the sentences, using the text.***

1. Water supports_____

2. Water shapes _____

3. One of the most important qualities of water _____

4. Oceans, seas, and other bodies of water interact _____

5. Uses of water include_____

***2. Find the correct endings for the sentences below.***

| | |
|---|---|
| 1. Water is present | A. materials. |
| 2. Water dissolves | B. make water a wonder on the earth. |
| 3. Water helps to keep | C. is made of water. |
| 4. The special qualities | D. in the air that surrounds the earth. |
| 5. Two thirds of the human body | E. air temperatures from getting too cold too fast. |

***3. Answer the questions:***

1. Are water resources useful to humans? Why?
2. Do you think it is necessary to make researches of the world ocean?
3. What role does the ocean play in the economic activities of the people?
4. What do you know about the fresh water sources?
5. Why it is so important for the state or nation to have the rights to use ocean resources?

**Groundwater**

**Groundwater** is water located beneath the ground surface. Groundwater is also often withdrawn for agricultural, municipal and industrial use by constructing and operating extraction wells. The study of the distribution and movement of groundwater is hydrogeology.

Groundwater makes up about twenty percent of the world's fresh water supply, which is about 0.61% of the entire world's water, including oceans and permanent ice. Global groundwater storage is roughly equal to the total amount of freshwater stored in the snow and ice pack, including the north and south poles.

Groundwater is also ecologically important. The importance of groundwater to ecosystems is often overlooked, even by freshwater biologists and ecologists. Ground waters sustain rivers, wetlands and lakes, as well as subterranean ecosystems.

The high specific heat capacity of water and the insulating effect of soil and rock can mitigate the effects of climate and maintain groundwater at a relatively steady temperature. In some places where groundwater temperatures are maintained by this effect at about 10°C, groundwater can be used for controlling the temperature inside structures at the surface. For example, during hot weather relatively cool groundwater can be pumped through radiators in a home and then returned to the ground in another well. During cold seasons, because it is relatively warm, the water can be used in the same way as a source of heat for heat pumps that is much more efficient than using air. The relatively constant temperature of groundwater can also be used for heat pumps.

Love Canal was one of the most widely known examples of groundwater pollution. In 1978, residents of the Love Canal neighborhood in upstate New York noticed high rates of cancer and an alarming number of birth defects. This was eventually traced to organic solvents and dioxins from an industrial landfill that the neighbourhood had been built over and around, which had then infiltrated into the water supply and evaporated in basements to further contaminate the air. Eight hundred families were reimbursed for their homes and moved, after extensive legal battles and media coverage.

Another example of widespread groundwater pollution is in the Ganges Plain of northern India and Bangladesh where severe contamination of groundwater by naturally occurring arsenic affects 25% of water wells.

***1.Give the Russian equivalents to the words and phrases:***

*is withdrawn, global groundwater storage, specific heat capacity of water, relatively constant temperature, high rates of cancer, birth defects, organic solvents, severe contamination.*

***2. Mark the sentences as True or False:***

1. Groundwater is water located over the ground surface.
2. The study of the distribution and movement of groundwater is hydrogeology.
3. Groundwater makes up about thirty percent of the world's fresh water supply.
4. Groundwater is also geologically important.

5. Scientists often overlook the importance of groundwater to ecosystems.

6. Groundwater can be used for controlling the temperature beneath the surface.

7. Love Canal and the Ganges Plain of northern India and Bangladesh are widely known for groundwater pollution.

***3. Answer the questions:***

1. What is hydrogeology?

2. Is groundwater important to ecosystems?

3. What is Love Canal famous for?

4. What happened in the Ganges Plain of northern India and Bangladesh?

## Freshwater

Water is a critical issue for the survival of all living organisms. Many can use salty water but many organisms including the great majority of higher plants and most mammals must have access to freshwater to grow bigger. Some terrestrial mammals, especially desert rodents appear to survive without drinking but they do generate water through the metabolism of cereal seeds and they also have mechanisms to conserve water to the maximum degree.

Only three percent of the water on Earth is freshwater, and about two-thirds of this is frozen in glaciers and most of the rest is underground and only 0.3 percent is surface water. Freshwater lakes, most notably Lake Baikal in Russia and the Great Lakes in North America, contain seven-eighths of this fresh surface water. Swamps have most of the balance with only a small amount in rivers, most notably the Amazon River. The atmosphere contains 0.04% water.

Freshwater is an important natural resource necessary for the survival of all ecosystems. The use of water by humans for activities such as irrigation and industrial applications can have adverse impacts on down-stream ecosystems. Chemical contamination of freshwater can also seriously damage eco-systems.

Pollution from human activity, including oil spills, also presents a problem for freshwater resources. The largest oil spill that has ever occurred in freshwater was caused by a Shell tank ship in Magdalena, Argentina, on January 15, 1999, polluting the environment, drinkable water, plants and animals.

The source of almost all freshwater is precipitation from the atmosphere, in the form of mist, rain and snow. A very small proportion is emitted from active volcanoes. Freshwater falling as mist, rain or snow contains materials dissolved from the atmosphere and material from the sea and land over which the rain bearing clouds have travelled.

In industrialized areas rain is typically acid because of dissolved oxides of sulphur and nitrogen formed from burning of fossil fuels in cars, factories, trains and aircraft and from the atmospheric emissions of industry. In extreme cases this causes acid rain which has caused severe pollution of lakes and rivers in parts of Scandinavia, Scotland, Wales and the United States.

In desert areas rain bearing winds can pick up sand and dust and this can be deposited elsewhere in precipitation and causing the freshwater flow to be measurably contaminated both by insoluble solids but also by the soluble components of those soils. This effect can cause unwelcome contamination with dust from the Chernobyl disaster being spread across Europe in rain clouds.

Changing landscape for the use of agriculture has a great effect on the flow of freshwater. Changes in landscape by the removal of trees and soils changes the flow of freshwater in the local environment and also affects the cycle of freshwater. As a result more freshwater is stored in the soil which benefits agriculture. However, since agriculture is the human activity that consumes the most freshwater, this can put a severe strain on local freshwater resources resulting in the destruction of local ecosystems.

Freshwater is a renewable and changeable, but limited natural resource. Freshwater can only be renewed through the process of the water cycle, where water from seas, lakes, rivers, and dams evaporates, forms clouds, and returns to water sources as precipitation. However, if more freshwater is consumed through human activities than is restored by nature, the result is that the quantity of freshwater available in lakes, rivers, dams and underground waters is reduced which can cause serious damage to the surrounding environment.

***1. Answer the questions:***

1. Is water a critical issue for the survival of all living organisms?

2. What percent of the water on the Earth is fresh water?

3. Which human activities can have adverse impacts on down-stream ecosystems?

4. Is fresh water nonrenewable or renewable natural resource?

5. What is the main source of almost all freshwater?

***2. Complete the sentences, using the text:***

1. Water is a critical issue for_____.2. About two-thirds of fresh water is _____.

3. Freshwater is an important natural resource necessary for _____.

4. Chemical contamination of freshwater can_____.

5. The source of almost all freshwater is_____.

6. In industrialized areas rain is typically acid because_____.

7. Acid rain can has cause severe pollution of lakes and rivers in parts of _____.

8. Freshwater is a renewable and changeable, but _____.

9. Changing landscape for the use of agriculture has a great effect on _____.

10. Freshwater can only be renewed through _____.

***3. Ask as many questions to this text as possible. Use all types of questions.***

**Sources of Fresh Water.**

***Match the following words with their Russian equivalents:***

| | |
|---|---|
| 1. irrigation methods | A. подача свежей воды |
| 2. power plant | B. районы, расположенные на высоте |
| 3. evaporation | C. обессоливание, опреснение |
| 4. intermittent | D. ёмкость для хранения |
| 5. supply of fresh water | E. прерывистый, прерывающийся |
| 6. storage capacity | F. электростанция |
| 7. desalination | G. употребление в большом количестве |
| 8. high-valued uses | H. методы орошения |
| 9. household uses | I. для домашнего употребления |
| 10. high altitude areas | J. испарение |

Surface water is water in a river, lake or fresh water wetland. Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation, and sub-surface seepage.

The total quantity of water available at any given time is an important consideration. Some human water users have an intermittent need for water. For example, many farms require large quantities of water in the spring, and no water at all in the winter. To supply such a farm with water, a surface water system may require a large storage capacity to collect water throughout the year and release it in a short period of time. Other users have a continuous need for water, such as a power plant that requires water for cooling. To supply such a power plant with water, a surface water system only needs enough storage capacity to fill in when average stream flow is below the power plant's need.

Desalination is an artificial process by which saline water (generally sea water) is converted to fresh water. The most common desalination processes are distillation and reverse osmosis. Desalination is currently expensive compared to most alternative sources of water, and only a very small fraction of total human use is satisfied by desalination. It is only economically practical for high-valued uses (such as household and industrial uses) in arid areas. The most extensive use is in the Persian Gulf.

Brazil is the country estimated to have the largest supply of fresh water in the world, followed by Russia and Canada.

Several schemes have been proposed to make use of icebergs as a water source.

The Himalayas, which are often called "The Roof of the World", contain some of the most extensive and rough high altitude areas on Earth as well as the greatest area of glaciers. Ten of Asia’s largest rivers flow from here and more than a billion people’s livelihoods depend on them.

As global population grows, and as demand for food increases in a world with a fixed water supply, there are efforts underway to learn how to produce more food with less water, through improvements in irrigation methods and technologies, agricultural water management, crop types, and water monitoring.

***1. Find out if the following statements are true or false.***

1. There are efforts underway to learn how to produce less food with more water.
2. Desalination is currently expensive compared to most alternative sources of water.
3. Ten of Asia's largest rivers flow from The Himalayas and more than a billion people's livelihoods depend on them.
4. Desalination is a natural process by which fresh water is converted to salt water.

***2. Answer the questions:***

1. What do you think are the main sources of fresh water in your own country?
2. What countries have the largest supply of fresh water in the world?
3. What is desalination? What do you know about this process?
4. Why it is so important to improve irrigation methods and technologies?

***3. Complete the sentences, using the text:***

1. As global population grows _____
2. Many farms require _____
3. The most extensive use of desalination is _____
4._____ are distillation and reverse osmosis.
5. The Himalayas contain some _____
6. To supply a power plant with water_____

**Sources of Drinking Water.**

1) The water emerging from some deep groundwater may have fallen as rain many decades or even hundreds of years ago. Soil and rock layers naturally filter the groundwater to a high degree of clarity before it is pumped to the treatment plant. Such water may emerge as springs, artesian springs, or may be extracted from boreholes or wells. Deep groundwater is generally of very high bacteriological quality. There may be a requirement to reduce the iron or manganese content of this water to make it pleasant for drinking, cooking, and laundry use. Disinfection is also required.

2) Water emerging from shallow groundwater is usually abstracted from wells or boreholes. The bacteriological quality can be variable depending on the nature of the catchment. A variety of soluble materials may be present including potentially toxic metals such as zinc and copper. Arsenic contamination of groundwater is a serious

problem in some areas, notably from shallow wells in Bangladesh and West Bengal in the Ganges Delta.

3) Typically located in the headwaters of river systems, upland reservoirs are usually sited above any human habitation and may be surrounded by a protective zone to restrict the opportunities for contamination. Bacteria and pathogen levels are usually low, but some bacteria, protozoa or algae will be present. Many upland sources have low pH which requires adjustment.

Low land surface waters will have a significant bacterial load and may also contain algae, suspended solids and a variety of dissolved constituents.

4) Atmospheric water generation is a new technology that can provide high quality drinking water by extracting water from the air by cooling the air and thus condensing water vapour. Rainwater harvesting or fog collections which collect water from the atmosphere can be used especially in areas with significant dry seasons.

***1. Answer the questions:***

1. What main sources of drinking water are mentioned in the text?
2. What quality has deep groundwater?
3. Where can we get shallow groundwater from?
4. What quality has water from upland lakes and reservoirs?
5. What is the technology of obtaining atmospheric water?

***2. Match the headings with the paragraphs:***

1. Upland lakes and reservoirs.
2. Deep groundwater.
3. Rivers, canals and low land reservoirs.
4. Shallow groundwater.

***3. Match the endings of the sentences with their beginnings:***

| | |
|---|---|
| 1. Low land surface waters | a. of very high bacteriological quality. |
| 2. The bacteriological quality can be variable | b. are usually low. |
| 3. Deep groundwater is generally | c. may contain algae and suspended solids. |
| 4. Bacteria and pathogen levels | d. depending on the nature of the catchment |

## UNIT 2.

## WATER QUALITY AND PUBLIC HEALTH

### Use of Water

1) It is estimated that 15% of worldwide water use is industrial. Major industrial users include power plants, which use water for cooling or as a power source, ore and oil refineries, which use water in chemical processes, and manufacturing plants, which use water as a solvent. The portion of industrial water usage that is consumptive varies widely, but as a whole is lower than agricultural use. Water is used in power generation. Hydroelectricity is electricity obtained from hydropower. It is a low-cost, non-polluting, renewable energy source. The energy is supplied by the sun. Heat from the sun evaporates water, which condenses as rain in higher altitudes, from where it flows down.

Water is also used in many industrial processes and machines, such as the steam turbine and heat exchanger, in addition to its use as a chemical solvent.

2) It is estimated that 15% of worldwide water use is for household purposes. These include drinking water, bathing, cooking, sanitation, and gardening. Basic household water requirements have been estimated at around 50 liters per person per day, excluding water for gardens. Drinking water is water that is of sufficiently high quality so that it can be consumed or used without risk of immediate or long term harm. Such water is commonly called potable water. In most developed countries, the water supplied to households, commerce and industry is all of drinking water standard even though only a very small proportion is actually consumed or used in food preparation.

3) Recreational water use is usually a very small but growing percentage of total water use. Recreational water use is mostly tied to reservoirs. If a reservoir is kept fuller than it would otherwise be for recreation, then the water retained could be categorized as recreational usage. Release of water from a few reservoirs is also timed to enhance boating, which also could be considered a recreational usage. Other examples are anglers, water skiers, nature enthusiasts and swimmers.

In 2000, the world population was 6.2 billion. The UN estimates that by 2050 there will be an additional 3.5 billion people with most of the growth in developing countries that already suffer water stress. Thus, water demand will increase unless there are corresponding increases in water conservation and recycling of this vital resource.

4) Business activity ranging from industrialization to services such as tourism and entertainment continues to expand rapidly. This expansion requires increased water services including both supply and sanitation, which can lead to more pressure on water resources and natural ecosystems.

5) The trend towards urbanization is accelerating. Small private wells and septic tanks that work well in low-density communities are not feasible within high-density urban areas. Urbanization requires significant investment in water infrastructure in order to deliver water to individuals and to process the concentrations of wastewater – both from individuals and from business. These polluted and contaminated waters must be treated or they pose unacceptable public health risks.

6) Climate change could have significant impacts on water resources around the world because of the close connections between the climate and hydrologic cycle. Rising temperatures will increase evaporation and lead to increases in precipitation, though there will be regional variations in rainfall. Overall, the global supply of freshwater will increase. Both droughts and floods may become more frequent in different regions at different times, and dramatic changes in snowfall and snowmelt are expected in mountainous areas. Higher temperatures will also affect water quality in ways that are not well understood. Possible impacts include increased eutrophication. Climate change could also mean an increase in demand for farm irrigation, garden sprinklers, and perhaps even swimming pools.

***1. Answer the questions:***

1. What is the percentage of worldwide water use for industrial purposes?
2. What kind of activities do household purposes include?
3. In what way power plants, ore and oil refineries, and manufacturing plants use water?

4. Why expanding business activity requires increased water services?

5. What do you know about climate change? Is it so dramatic in your own country?

***2. Match the following words with definitions:***

| | |
|---|---|
| household | an overflow or accumulation of an expanse of water that submerges land. |
| industrialization | treatment of water |
| flood | the basic systems or equipment needed for an industry or business to operate successfully |
| infrastructure | an extended period of months or years when a region notes a deficiency in its water supply |
| renewable | the fertilization of surface water by nutrients |
| sanitation | will continue to exist or will grow again and are therefore never used up |
| urbanization | the business of films, TV, theatre productions |
| eutrophication | building houses or towns in the countryside |
| drought | connected with looking after a house and the people in it |
| entertainment | developing a lot of industry |

***3. Put the words in to the gaps:***

1. Higher temperatures will also affect _____ in ways that are not well understood.

2. Urbanization requires _____ in water infrastructure in order to deliver water to _____.

3. _____ can lead to more pressure on water resources and natural ecosystems.

4. Household purposes include_____.

5. Hydroelectricity is electricity obtained from_____.

6. Water is used in power_____.

7. Climate change could mean an increase in_____.

8. Water is also used in _____and machines, such as the steam turbine and heat exchanger, in addition to its use as a chemical solvent.

9. Polluted and contaminated waters must be treated_____.

10. Heat from the sun _____water.

***4. Match the headings with the correct paragraph:***

1. Water supply to households.
2. Expansion of business activity.
3. Significant impacts of climate change.
4. Industrial water usage.
5. Rapid urbanization.

## Water Quality

Water quality is the physical, chemical and biological characteristics of water. The most common standards used to assess water quality relate to drinking water, safety of human contact and for the health of ecosystems.

In the setting of standards, agencies make political and technical/scientific decisions about how the water will be used. In the case of natural water bodies, they also make some reasonable estimate of pristine conditions. Different uses raise different concerns and therefore different standards are considered. Natural water bodies will vary in response to environmental conditions. Environmental scientists work to understand how these systems function which in turn helps to identify the sources and fates of contaminants. Environmental lawyers and policy makers work to define legislation that ensures that water is maintained at an appropriate quality for its identified use.

The vast majority of surface water on the planet is neither potable nor toxic. In fact, water quality is a very complex subject, in part because water is a complex medium intrinsically tied to the ecology of the Earth. Industrial pollution is a major cause of water pollution, as well as runoff from agricultural areas, urban storm water runoff and discharge of treated and untreated sewage (especially in developing countries).

The parameters for water quality are determined by the intended use. Work in the area of water quality tends to be focused on water that is treated for human consumption or in the environment.

Contaminants that may be in untreated water include microorganisms such as viruses and bacteria; inorganic contaminants such as salts and metals; pesticides and

herbicides; organic chemical contaminants from industrial processes and petroleum use; and radioactive contaminants.

Water quality depends on the local geology and ecosystem, as well as human uses such as sewage dispersion, industrial pollution, use of water bodies as a heat sink, and overuse.

Some people use water purification technology to remove contaminants from the municipal water supply they get in their homes, or from local pumps or bodies of water. For people who get water from a local stream, lake, or aquifer (well), their drinking water is not filtered by the local government.

***1. Give the Russian equivalents to the words and phrases:***

*to make technical/scientific decisions, reasonable estimate, environmental conditions, to define legislation, an appropriate quality, discharge of treated and untreated sewage, pesticides and herbicides, the local geology and ecosystem, water purification technology.*

***2. Answer the questions:***

1. What is water quality? Which characteristics are used to test it?
2. Are there different standards of safety for different uses of water? Why?
3. What is the main cause of water pollution?
4. Which contaminants can be found in untreated water?
5. What does water quality depend on?
6. Is *water quality* a simple subject? Why?

***3. Which statements are True (T) or false (F) according to the article?***

1. Water quality depends on numerous factors.
2. The parameters for water quality are determined by the intended use.
3. Water is a complex medium separated from all Earth systems.
4. Industrial pollution is the major cause of water pollution.
5. Environmental scientists work hard to identify the sources and fates of contaminants.

## Environmental Water Quality

**Match the following words with their Russian equivalents:**

| | |
|---|---|
| 1. toxic substances | A. первоначальный, прежний |
| 2. landscape | B. достижение целей |
| 3. achieving goals | C. жидкий кислород |
| 4. alkalinity | D. землетрясения |
| 5. dissolved oxygen | E. вымирающие виды |
| 6. earthquakes | F. пейзаж |
| 7. endangered species | G. токсичные вещества |
| 8. designation | H. щёлочность |
| 9. pristine | I. полив |
| 10. irrigation | J. обозначение, определение |

Environmental water quality, also called *ambient* water quality**,** relates to water bodies such as lakes, rivers, and oceans. Water quality standards vary significantly due to different environmental conditions, ecosystems, and intended human uses. Toxic substances and high populations of certain microorganisms can present a health hazard for non-drinking purposes such as irrigation, swimming, fishing, rafting, boating, and industrial uses. These conditions may also affect wildlife which uses the water for drinking or as a habitat. Modern water quality laws general specify protection of fisheries and recreational use and require as a minimum, retention of current quality standards.

There is some desire among the public to return water bodies to pristine or pre-industrial conditions. Most current environmental laws focus of the designation of uses. In some countries these allow for some water contamination as long as the particular type of contamination is not harmful to the designated uses. Given the landscape changes in the watersheds of many freshwater bodies, returning to pristine conditions would be a significant challenge. In these cases, environmental scientists focus on achieving goals for maintaining healthy eco-systems and may concentrate of the protection of populations of endangered species and protecting human health.

The complexity of water quality as a subject is reflected in the many types of measurements of water quality indicators. Some of the simple measurements listed below can be made on-site — temperature, pH, dissolved oxygen, conductivity, in

direct contact with the water source in question. More complex measurements that must be made in a lab setting require a water sample to be collected, preserved, and analyzed at another location. Making these complex measurements can be expensive. Because direct measurements of water quality can be expensive, ongoing monitoring programs are typically conducted by government agencies. However, there are local volunteer programs and resources available for some general assessment.

Inevitably after events such as earthquakes and Tsunamis, there is an immediate response by the aid agencies as relief operations get underway to try and restore basic infrastructure and provide the basic fundamental items that are necessary for survival and subsequent recovery. Access to clean drinking water and adequate sanitation is a priority at times like this. The threat of disease increases hugely due to the large numbers of people living close together, often in squalid conditions, and without proper sanitation.

After a natural disaster, as far as water quality testing is concerned there are widespread views on the best course of action to take and a variety of methods can be employed. There are a number of potable water test kits on the market widely used by aid and relief agencies for carrying out such testing.

The following is a list of indicators often measured by situational category for drinking water: alkalinity, color of water, pH, taste and odor, dissolved metals and salts (sodium, chloride, potassium, calcium, manganese, magnesium), microorganisms, dissolved metals and metalloids (lead, mercury, arsenic), dissolved organics, radon, heavy metals, pharmaceuticals and hormone analogs.

***1. Answer the questions:***

1. What is *ambient* water quality?
2. What do you know about the modern water quality laws?
3. What do the environmentalists do to protect water bodies?
4. What kinds of measurement do you know?
5. Which indicators are used to measure the quality of drinking water?

***2. Complete the sentences, using the text:***

1. Water quality standards vary_____

2. Toxic substances and high populations of certain microorganisms can present ____

3. Some of the simple measurements listed below can be made on-site_____

4. There are a number of potable water test kits_____

5. The following is a list of indicators often measured by situational category for drinking water: _____

**3. Fill in the gaps:**

1. Environmental water quality, also called_____**,** relates to water bodies such as lakes, rivers, and oceans.

2. These conditions may also affect _____which uses the water for drinking or as a habitat.

3. There is some desire among the _____ to return water bodies to pristine or pre-industrial conditions.

4. Environmental scientists focus on _____for maintaining_____.

**Drought**

A **drought** is an extended period of months or years when a region notes a deficiency in its water supply. It can have a substantial impact on the ecosystem and agriculture of the affected region. Although droughts can persist for several years, even a short, intense drought can cause significant damage and harm the local economy. This global phenomenon has a widespread impact on agriculture. The United Nations estimates that an area of fertile soil the size of Ukraine is lost every year because of drought, deforestation, and climate instability.

Drought is a normal, recurring feature of the climate in most parts of the world. It is among the earliest documented climatic events.

Periods of drought can have significant environmental, agricultural, health, economic and social consequences. The effect varies according to vulnerability. For example, subsistent farmers are more likely to migrate during drought because they do not have alternative food sources. Areas with populations that depend on subsistence farming as a major food source are more vulnerable to drought-triggered famine. Drought is rarely if ever the sole cause of famine; socio-political factors such as extreme widespread poverty play a major role. Drought can also reduce water

quality, because lower water flows reduce dilution of pollutants and increase contamination of remaining water sources.

A few common consequences of drought include:

- Famine due to lack of water for irrigation;
- Habitat damage, affecting both terrestrial and aquatic wildlife.
- Dehydration and related diseases;
- Mass migration;
- Shortages of water for industrial users;
- Snakes migration and increases in snakebites;
- Social unrest;
- War over natural resources, including water and food;

As a drought persists, the conditions surrounding it gradually worsen and its impact on the local population gradually increases. People tend to define droughts in three main ways:

1. Meteorological drought is brought about when there is a prolonged period with less than average precipitation. Meteorological drought usually precedes the other kinds of drought.

2. Agricultural droughts are droughts that affect crop production or the ecology of the range. This condition can also arise independently from any change in precipitation levels when soil conditions and erosion triggered by poorly planned agricultural endeavors cause a shortfall in water available to the crops.

3. Hydrological is brought about when the water reserves available in sources such as aquifers, lakes and reservoirs fall below the statistical average. Hydrological drought tends to show up more slowly because it involves stored water that is used but not replenished. Like an agricultural drought, this can be triggered by more than just a loss of rainfall.

***1. Answer the questions:***

1. What is drought?
2. Does this global phenomenon have a widespread impact on ecosystems and agriculture?

3. What are the common consequences of a drought?

4. What are the main ways to define a drought?

5. What is a hydrological drought?

***2. Complete the sentences:***

1. Droughts have a widespread_____.

2. An area of fertile soil the size of Ukraine is lost every year because of_____.

3. Periods of drought can have significant_____.

4. Drought can also reduce _____.

5. A few common consequences of drought include_____.

6. People tend to define droughts_____.

7. Meteorological drought is_____.

8. Agricultural droughts are _____.

9. Hydrological drought is brought _____.

10. As a drought persists, the conditions surrounding it gradually _____.

***3. Ask as many questions to the text as possible. Use all types of questions.***

**Flood**

A flood is an overflow or accumulation of an expanse of water that submerges land. Flooding may result from the volume of water within a body of water, such as a river or lake, which overflows or breaks levees, with the result that some of the water escapes its normal boundaries. While the size of a lake or other body of water will vary with seasonal changes in precipitation and snow melt, it is not a significant flood unless such escapes of water endanger land areas used by man like a village, city or other inhabited area.

Floods can also occur in rivers, when the strength of the river is so high it flows out of the river channel and causes damage to homes and businesses along such rivers.

Rivering floods are classified into two groups, slow and fast.

Slow kind is runoff from sustained rainfall or rapid snow melt exceeding the capacity of a river's channel. Causes include heavy rains from monsoons, hurricanes and tropical depressions, foreign winds and warm rain affecting snow pack.

Fast kinds include flash floods resulting from convective precipitation (intense thunderstorms) or sudden release from an upstream impoundment created behind a dam, landslide, or glacier.

Coastal floods caused by severe sea storms, or as a result of another hazard (tsunami or hurricane). Catastrophic floods, caused by a significant and unexpected event (dam breakage), or as a result of another hazard (earthquake or volcanic eruption).

Physical damage can range anywhere from bridges, cars, buildings, sewer systems, roadways, canals and any other type of structure.

People and livestock die due to drowning. It can also lead to epidemics and waterborne diseases. Clean drinking water becomes scarce. Spread of water-borne diseases happens due to unhygienic conditions. Shortage of food crops can be caused due to loss of entire harvest. Non-tolerant species of flora and fauna can die from suffocation. Economic hardship is evident due to temporary decline in tourism, rebuilding costs, food shortage leading to price increase.

Remembering the misery and destruction caused by the 1910 Great Flood of Paris, the French government built a series of reservoirs which helps remove pressure from the Seine during floods, especially the regular winter flooding. London is protected from flooding by a huge mechanical barrier across the River Thames, which is raised when the water level reaches a certain point.

Venice has a similar arrangement, although it is already unable to cope with very high tides.

Currently the Saint Petersburg Flood Prevention Facility Complex was finished in 2008, in Russia, to protect Saint Petersburg from storm surges. It also has a main traffic function, as it completes a ring road around Saint Petersburg. Eleven dams extend for 25.4 kilometres and stand eight metres above water level.

In Egypt, both the Aswan Dam (1902) and the Aswan High Dam (1976) have controlled various amounts of flooding along the Nile river.

Clean-up activities following floods often pose hazards to workers and volunteers involved in the effort. Potential dangers include: electrical hazards, heat or cold stress, fire, drowning, and exposure to hazardous materials. In planning for and reacting to flood disasters, managers provide workers with hard hats, goggles, heavy work gloves, life jackets, and watertight boots with steel toes and insoles. There are many disruptive effects of flooding on human settlements and economic activities. However, floods (in particular the more frequent/smaller floods) can bring many benefits, such as recharging ground water, making soil more fertile and providing nutrients in which it is deficient. Flood waters provide much needed water resources in particular in arid and semi-arid regions where precipitation events can be very unevenly distributed throughout the year. Freshwater floods in particular play an important role in maintaining ecosystems in river corridors and are a key factor in maintaining floodplain biodiversity.

***1. Answer the questions:***

1. What is a flood? Where does it result from?
2. What is the classification of a flood?
3. What is the difference between the slow kind of a flood and the fast one?
4. What is the reason for coastal flood to occur?
6. Are the effects of the flood dramatic?
7. Is a contamination of water an integral part of floods?
8. What happens with crops and food supplies?
9. How people protect their places?
10. Is there any danger for workers and volunteers in clean-up activity?
11. What uniform have workers and volunteers wear to protect themselves from electrical hazards, heat or cold stress, fire, drowning, and exposure to hazardous materials?
12. Are there any benefits of flood? What are they?

***2. Fill in the gaps:***

1. Flooding may result from the volume of water within a body of water, such as a river or lake, which _____with the result that some of the water escapes its normal boundaries.

2. Floods can also occur in rivers, when the strength of the river is so high it flows out of the river channel and causes damage to _____along such rivers.

3. _____ floods are classified into two groups:_____.

4. Causes of the _____include heavy rains from monsoons, hurricanes and tropical depressions, foreign winds and warm rain affecting snow pack.

5. Fast kinds include flash floods resulting from _____ or _____ created behind a dam, landslide, or glacier.

6. _____ caused by a significant and unexpected event, or as a result of another hazard.

7. _____ can range anywhere from bridges, cars, buildings, sewer systems, roadways, canals and any other type of structure.

8. Spread of water-borne diseases happens due to_____ .

9. Non-tolerant species of flora and fauna can die_____.

10. Floods can bring many benefits, such as _____.

**3. Make up a summary of this text.**

## Water cycle

***Match the following words with their Russian equivalents:***

| | |
|---|---|
| 1. water cycle | A. испаряться из почвы |
| 2. on the surface of the globe | B. поднимающиеся воздушные потоки |
| 3. to evaporate from the soil | C. пополнить водоносный пласт |
| 4. rising air currents | D. химический состав |
| 5. precipitation | E. на поверхности глобуса |
| 6. to replenish aquifers | F. строительство плотин |
| 7. urbanization | G. градостроительство |
| 8. transpiration | H. просачивание |
| 9. construction of dams | I. выпадение осадков |
| 10.chemical composition | J. круговорот воды |

The water cycle describes the continuous movement of water below, above and on the surface of the globe. Since the water cycle is truly a "cycle," there is no beginning or end. Water can change states among liquid, vapor, and ice at various places in the water cycle.

The sun, which drives the water cycle, heats water in the oceans. Water evaporates as vapor into the air. Rising air currents take the vapor up into the atmosphere where cooler temperatures cause it to condense into clouds. Air currents move clouds around the globe; cloud particles collide, grow, and fall out of the sky as precipitation. Some precipitation falls as snow and can accumulate as ice caps and glaciers, which can store frozen water for thousands of years. Snow packs can melt, and the melted water flows over land as snowmelt. A portion of runoff enters rivers in valleys. Runoff and groundwater are stored as freshwater in lakes. Not all runoff flows into rivers. Much of it soaks into the ground as infiltration. Some water infiltrates deep into the ground and replenishes aquifers, which store huge amounts of freshwater for long periods of time. Some infiltration stays close to the land surface and can seep back into surface-water bodies (and the ocean) as groundwater discharge. Some groundwater finds openings in the land surface and comes out as freshwater springs. Over time, the water returns to the ocean, where our water cycle started.

Groundwater can spend over 10,000 years beneath Earth's surface before leaving. Particularly old groundwater is called fossil water. After evaporating, the residence time in the atmosphere is about 9 days before condensing and falling to the Earth as precipitation.

The water cycle describes the processes that drive the movement of water throughout the hydrosphere. However, much more water is "in storage" for long periods of time than is actually moving through the cycle. The storehouses for the vast majority of all water on Earth are the oceans. It is estimated that about 95% of the world's water supply is stored in oceans.

During colder climatic periods more ice caps and glaciers form, and enough of the global water supply accumulates as ice. During the last ice age glaciers covered

almost one-third of Earth's land mass, with the result being that the oceans were about 122 m lower than today. During the last global "warm spell," about 125,000 years ago, the seas were about 5.5 m higher than they are now. About three million years ago the oceans could have been up to 50 m higher.

The scientific consensus expressed the water cycle to continue to intensify throughout the 21st century, though this does not mean that precipitation will increase in all regions. In subtropical land areas — places that are already relatively dry — precipitation is projected to decrease during the 21st century, increasing the probability of drought. The drying is projected to be strongest near the subtropics (for example, the Mediterranean Basin, South Africa, southern Australia, and the Southwestern United States).

Glacial retreat is also an example of a changing water cycle, where the supply of water to glaciers from precipitation cannot keep up with the loss of water from melting. Glacial retreat since 1850 has been extensive.

Human activities that alter the water cycle include:

- agriculture
- industry
- alteration of the chemical composition of the atmosphere
- construction of dams
- deforestation
- urbanization

The water cycle is powered from solar energy. 86% of the global evaporation occurs from the oceans. Without the cooling effect of evaporation the greenhouse effect would lead to a much higher surface temperature of 67 °C, and a warmer planet.

***1. Answer the questions:***

1. What is water cycle?
2. What is the role of the sun in that process?
3. How much time ice caps and glaciers can store frozen water?
4. What are the forecasts of the scientists relatively the water cycle to continue?

5. What are human activities that alter the water cycle?

***2. Define the sentences as true or false:***

1. The water cycle describes the continuous movement of water just on the surface of the globe.
2. Water can change states among liquid and ice at various places in the water cycle.
3. Groundwater can spend over 10,000 years beneath Earth's surface.
4. Over time, the water returns to the ocean, where our water cycle finished.
5. The water cycle describes the processes that drive the movement of water throughout the biosphere.
6. Deforestation is one of the human activities that alter the water cycle.
7. The water cycle is powered from nuclear power energy.
8. Some part of the global evaporation occurs from the oceans.
9. The Mediterranean Basin, South Africa, southern Australia, and the Southwestern United States are near the subtropics.
10. What is the reason for our planet to get warmer?

**Water crisis**

Water crisis is a term that has been used by some to refer to the world's water resources relative to human demand. The term has been applied to the worldwide water situation by the United Nations and other world organizations. Others, for example the Food and Agriculture Organization, claim there is no water crisis. The major aspects of the water crisis are allegedly overall scarcity of usable water and water pollution.

2 billion people have gained access to a safe water source since 1990. The proportion of people in developing countries with access to safe water is calculated to have 79 percent in 2000 and 84 percent in 2004, parallel with rising population. This trend is projected to continue.

The Earth has a finite supply of fresh water, stored in aquifers, surface waters and the atmosphere. Sometimes oceans are mistaken for available water, but the amount of energy needed to convert saline water to potable water is prohibitive

today, explaining why only a very small fraction of the world's water supply derives from desalination.

Waterborne diseases and the absence of sanitary domestic water are one of the leading causes of death worldwide. For children under age five, waterborne diseases are the leading cause of death. At any given time, half of the world's hospital beds are occupied by patients suffering from waterborne diseases. According to the World Bank, 88 percent of all diseases are caused by unsafe drinking water, inadequate sanitation and poor hygiene.

According to recent numbers by UNICEF and the World Health Organization, there are an estimated 884 million people without adequate drinking water, and a correlating 2.5 billion without adequate water for sanitation.

There are approximately 260 different river systems worldwide, where conflicts exist crossing national boundaries. The Tigris-Euphrates River System is one example where differing national interests and withdrawal rights have been in conflict. The countries of Iran, Iraq and Syria each present valid claim of certain water use, but the total demands on the rivering system surpass the physical constraints of water availability.

In 1992 Hungary and Czechoslovakia took a dispute over Danube River water diversions and dam construction to the International Court of Justice. This case represents a minority of disputes where logic and jurisprudence may be the path of dispute resolution. Other conflicts involving North and South Korea, Israel and Palestine, Egypt and Ethiopia, may prove more difficult tests of negotiation.

There are many other countries of the world that are severely impacted with regard to human health and inadequate drinking water. The following is a partial list of some of the countries with significant populations whose only consumption is of contaminated water: Sudan (12.3 million), Venezuela (5 million), Zimbabwe (2.7 million), Tunisia (2.1 million), Cuba (1.2 million).

A range of local, low-tech solutions are being pursued by a number of companies. These efforts center on the use of solar power to distill water at temperatures slightly beneath that at which water boils. By developing the capability

to purify any available water source, local business models could be built around the new technologies, accelerating their uptake.

Nanotechnology could also end the water crisis by the year 2025 as water will be produced in nanofactories at a sub-atomic level in infinite amounts. Creating the water from the basic elements would require no electricity or fossil fuels to do; providing that green nanotechnology is used in the process.

***1. Give Russian equivalents to the following words and phrases:***

*crossing national boundaries, North and South Korea, low-tech solutions, fossil fuels, solar power, dam construction, inadequate sanitation, a number of companies, local business, human health, to convert saline water to potable water.*

***2. Answer the questions:***

1. Is there any progress in developing countries with access to safe water?
2. Why oceans are mistaken for available water?
3. What are the leading causes of death worldwide?
4. What countries have a conflict due water availability?
5. What countries consume just contaminated water?
6. How are scientists going to create water using nanotechnology?

**3. Fill in the gaps in the sentences:**

1. _____is a term that has been used by some to refer to the world's water resources relative to human demand.
2. 2 billion people have gained access to a _____since 1990.
3. According to recent numbers_____ 2.5 billion people without adequate water for sanitation.
4. The Earth has_____, stored in aquifers, surface waters and the atmosphere.
5. _____and the absence of _____are one of the leading causes of death worldwide.
6. According to _____, 88 percent of all diseases are caused by unsafe drinking water.

7. In 1992 _____took a dispute over Danube River water diversions and dam construction to the International Court of Justice.

8. There are many other countries of the world that are severely impacted with regard to _____and_____.

9. _____could be built around the new technologies.

10. _____could also end the water crisis by the year 2025.

## Water and Public Health

***Match the following words with their Russianequivalents.***

| | |
|---|---|
| 1. waterborne diseases | A. диарея |
| 2. morbidity | B. слепота |
| 3. mortality | C. заболевания связанные с плохой |
| 4. per capita | D. плохие санитарные условия |
| 5. poor sanitation | E. смертельность |
| 6. infectious disease | F. основной доступ |
| 7. blindness | G. инфекционное заболевание |
| 8. diarrhea | H. на душу населения |
| 9. typhoid | I. болезненность |
| 10. basic access | J. тиф |

Both an adequate amount of water and adequate water quality are essential for public health and hygiene. Waterborne diseases are among the leading causes of morbidity and mortality in low- and middle-income countries, frequently called developing countries. For example, an estimated 900 million people suffer (and approximately 2 million die) from water-related diarrheal illnesses each year. At least 17 percent of human diseases in many developing countries can be attributed to diarrhea.

The most common waterborne diseases are diarrhea, typhoid and cholera. Another example is trachoma, an infectious disease of the eye, which results in many cases of blindness in developing countries, which is associated with poor water supply and poor sanitation.

The World Health Organization has defined around 20 liter per capita per day as basic access, which implies high health concerns, and 100 liter per capita per day as optimal access, associated with low health concerns.

**1. Make up as many questions to this text as you can. All questions should be answered.**

**2. Make up a summary of the text.**

## UNIT 3

## WATER SUPPLY

### Global Access to Water Supply

***Match the words with their Russian equivalents:***

| | |
|---|---|
| 1. to saturate | A. слои, пласты |
| 2. water precipitates | B. бедственные результаты |
| 3.a desert | C. источник водоснабжения |
| 4.a marsh | D. болото, топь |
| 5. to evaporate | E. неадекватный доступ |
| 6. stratum | F. глобальное население |
| 7. global population | G.превращаться в пар |
| 8. disastrous results | H. пропитывать, насыщать |
| 9. source of water supply | I. пустыня |
| 10. inadequate access | J. водные осадки |

Water is an important part of nature which surrounds us and of those natural conditions we are changing constantly and ever more intensively: the flora, the soil, the mountains, mineral resources, the deserts, the marshes, the steppes and the taiga.

Water passes through a very interesting natural cycle. The atmosphere which surrounds the earth’s surface contains water which varies in amount in direct proportion to the temperature of its gases. Water is also evaporated into atmosphere. Atmosphere which has become saturated with water precipitates its moisture when the temperature lowers. This phenomenon is termed rainfall. The moisture falls to the earth and finds its way into a number of reservoirs provided by nature.

Vast depressions in the earth are filled with water through the medium of natural water sources such as rivers and lakes over the earth surface. These bodies of water are classified as inland lakes and are excellent sources of water.

Sometimes the rainfall finds its way into the soil and forms water bodies at various levels because of the impervious nature of the under soil. Often a water body deep in the soil consists of a sand or gravel stratum which connects or empties into the basin of an inland lake and provides a splendid source of water supply through the medium of a drilled well.

In 2004 about 3.5 billion people worldwide (54% of the global population) had access to piped water supply through house connections. Another 1.3 billion (29%) had access to safe water through other means than house connections, including standpipes, protected springs and protected wells. Finally, more than 1 billion people (10%) did not have access to safe water, meaning that they have to revert to unprotected wells or springs, canals, lakes or rivers to fetch water. An example of the challenges posed by inadequate access to water supply can be found in the entry on water and sanitation in Latin America.

Man uses water for domestic and sanitary purposes and returns it to the source through sewage disposal system. Industry likewise replaces water diverted to its use. Hence the cycle is completed but it is of prime importance that the supply be protected against pollution, for if it fouls no one can predict how disastrous may be the results.

**1. Answer the questions:**

1. What natural cycle does water pass through?
2. Are inland lakes are the excellent sources of water?
3. What purposes do people use water for?
4. What percentage of people do not have water supply?

**2. Complete the sentences, using the text:**

1. Water is an important part of nature which surrounds us and of those natural conditions we are changing constantly and ever more intensively: _____
2. The atmosphere which surrounds the earth's surface contains _____

3. Sometimes the rainfall finds its way into the soil and forms_____

4. Man uses water for_____

5. Water is also evaporated into_____

**3. Fill in the gaps:**

1. _____ passes through a very interesting natural cycle.

2. Atmosphere which has become _____ with water precipitates its moisture when the temperature lowers.

3. The moisture _____ to the earth and finds its way into a number of _____ provided by nature.

4. Often a water body deep in _____ consists of _____which connects or empties into the basin of an inland lake.

5. Industry likewise replaces water diverted to its use.

**Technical Overview of Water supply**.

An adequate supply of pure, wholesome and palatable water is essential to the maintenance of high standards of health and to provide the convenience modern society demands. In some localities water is available in unlimited quantities and converting it to use is not a difficult problem. This is especially true of towns situated on large inland lakes or rivers. On the other hand there are cities where geographical location requires elaborate systems of water supply, and to provide a satisfactory supply of water in these localities becomes a large engineering task.

The importance of a sufficient supply of water for domestic and industrial purpose has long been a deciding factor in the location of cities. The earliest settlers realized this need and took advantage of natural water sources by establishing colonies in close proximity to them.

Water may be taken from any sources of water for human consumption after it has undergone a preliminary treatment to assure its purity. As man's communities grew in population, the demand for water increased and the need for protection of the source of water supply against the possibility of contamination became evident. Progress and civilization have called for elaborate and various systems and methods of water treatment.

Water supply systems get water from a variety of locations, including groundwater (aquifers), surface water ( lakes and rivers), and the sea through the desalination. The water is then, in most cases, purified, disinfected through chlorination. Treated water then either flows by gravity or is pumped to reservoirs, which can be elevated such as water towers or on the ground. Once water is used, wastewater is typically discharged in a sewer system and treated in a wastewater treatment plant before being discharged into a river, lake or the sea or reused for landscaping, irrigation or industrial use.

Many of the 3.5 billion people having access to pipe water receive a poor or very poor quality of service, especially in developing countries where about 80% of the world population lives. Water supply service quality has many dimensions: continuity; water quality; pressure; and the degree of responsiveness of service providers to customer complaints.

Drinking water quality has a micro-biological and a physico-chemical dimension. There are thousands of parameters of water quality. In public water supply systems water should, at a minimum, be disinfected - usually through chlorination - or it may need to undergo treatment, especially in the case of surface water.

Water pressures vary in different locations of a distribution system. Water mains below the street may operate at higher pressures, with a pressure reducer located at each point where the water enters a building or a house. In poorly managed systems, water pressure can be so low as to result only in a trickle of water or so high that it leads to damage to plumbing fixtures and waste of water. Pressure in an urban water system is typically maintained either by a pressurized water tank serving an urban area, by pumping the water up into a tower and relying on gravity to maintain a constant pressure in the system or solely by pumps at the water treatment plant and repeater pumping stations.

Continuity of water supply is taken for granted in most developed countries, but is a severe problem in many developing countries, where sometimes water is only

provided for a few hours every day or a few days a week. It is estimated that about half of the population of developing countries receives water on an intermittent basis.

***1. Give the Russian equivalents to the words and phrases:***

*wholesome and palatable water, the convenience modern society demands, elaborate systems of water supply, human consumption, disinfected through chlorination, a wastewater treatment plant, micro-biological dimension, plumbing fixtures.*

***2. Answer the questions:***

1. Why the quality and quantity of supplied water is different in different places?
2. How the earliest settlers took decision to establish the colony at some place? What was the first reason for them to settle?
3. What are the dimensions for supply service quality?
4. Why water pressures vary in different locations?
5. Do you have an intermittent basis of providing water into your place?

***3. Match the words with the definitions:***

| | |
|---|---|
| locations | people in general considered in relation to the structure of laws and organizations |
| developing country | the place where something is |
| population | the supply of treated and purified water for a community |
| urban area | a drain or a pipe that is underground used to carry away surface water |
| treatment | water that is acceptable or satisfactory |
| waste | the number of people who live in particular country or area |
| a sewer | a non-industrialized poor country that is seeking to develop its resources by industrialization |
| palatable water | a particular way of dealing with smth |
| society | a city area |
| water supply | unwanted materials or substances that are left after a particular process |

## *Elements of Water Supply System.*

## *World Water Supply Distribution*

***Match the words with their Russian equivalents:***

1. a water-supply system — A. распределительная система труб
2. a reservoir for storing water — B. физическая нехватка

| | |
|---|---|
| 3. flow of water | C. перенаселение |
| 4. conduit | D. доступные водные ресурсы |
| 5. a treatment plant | E. система водоснабжения |
| 6. a distribution system of pipes | F. поток воды |
| 7. adequate sanitation | G. очистная установка |
| 8. overpopulation | H. резервуар для хранения воды |
| 9. available water resources | I. канал, трубопровод |
| 10. physical scarcity | J. соответствующие санитарные условия |

A water-supply system consists essentially of the following parts: a source of supply, which may be a lake, stream, spring, or well; a reservoir for storing water for use during periods when demand is greater than the daily flow of water; conveying the water from the source of supply to the community is accomplished by means of a pipe line or a conduit; removing impurities from the water to make it suitable for use requires a treatment plant; and a distribution system of pipes is used for delivering the water throughout the various streets of the community.

Some systems are simpler and consist only of a source of supply, a main pipe line, and a small amount of distribution piping; others are more complicated and include, in addition to the elements previously listed, distribution reservoirs, pumping plants, and other accessories.

Food and water are two basic human needs. However, global coverage figures from 2002 indicate that, of every 10 people:

1) roughly 5 have a connection to a piped water supply at home (in their dwelling, plot or yard);

2) 3 make use of some other sort of improved water supply, such as a protected well or public standpipe;

3) 2 are unserved;

4) in addition, 4 out of every 10 people live without improved sanitation.

In 2025 water shortages will be more prevalent among poorer countries where resources are limited and population growth is rapid, such as the Middle East, Africa, and parts of Asia. By 2025, large urban and peri- urban areas will require new

infrastructure to provide safe water and adequate sanitation. This suggests growing conflicts with agricultural water users, who currently consume the majority of the water used by humans.

Generally speaking the more developed countries of North America, Europe and Russia will not see a serious threat to water supply by the year 2025; not only because of their relative wealth, but more importantly their populations will be better aligned with available water resources. North Africa, the Middle East, South Africa and northern China will face very severe water shortages due to physical scarcity and a condition of overpopulation relative to their carrying capacity with respect to water supply. Most of South America, Sub-Saharan Africa, Southern China and India will face water supply shortages by 2025; for these latter regions the causes of scarcity will be economic constraints to developing safe drinking water, as well as excessive population growth.

***1. Answer the questions:***

1. What does a water-supply system consist of?
2. What is a difference between simple water supply system and more complicated one?
3. What are the reasons for water shortages in the countries of the Middle East, Africa, and parts of Asia?
4. Is the situation in the countries of North America and Europe different from the situation in poorer countries?
5. Do you have any forecasts about the situation in your own country for the nearest future?

***2. Complete the sentences, using the text:***

1. Food and water are two _____.
2. A reservoir for storing water is used during _____.
3. A distribution system of pipes is used for _____.
4. By 2025 large urban and peri- urban areas will require new infrastructure to_____.

5. North Africa, the Middle East, South Africa and northern China will face very severe water shortages due to_____.

***3. Make up a summary of the text.***

**Purification of Water Supply**

Water taken from its natural source - the ground lakes or rivers - contains many objectionable elements. It may possess gases of an obnoxious nature, bacteria, mineral elements, mud, and suspended vegetable growths which render it unpalatable. Some of these objectionable materials may be eliminated readily, others require complex treatment.

The obnoxious gases are removed by aerating the water. Some of the mineral elements, such as certain forms of iron, also are removed by this means. The suspended materials require coagulation and settling process, and bacteria are eliminated with the addition of chemicals and sand filtration. The mineral elements which render the water hard must be separated by a chemical process in which the objectionable element is replaced by one that is favorable. A filtration plant may use one or a combination of all of these processes through the plant.

***1. Give at least three variants of answers to the questions:***

1. What is necessary for protecting the purity of natural water resources?
2. Why do large modern cities suffer mostly from water pollution?

***2. Disprove next points of view with at least three sentences:***

1. The problem of protecting natural water resources is of little importance as compared to other problems of our age.
2. After primary treatment polluted water may be used for drinking.

**From the History of Water Supply**

Water is a power not only in the hydraulic sense, but in relation to progress and culture; campaigns as well as fortresses have been lost, projects rendered impracticable and communities have decayed for want of water.

Nature has provided prototypes for most of man's devices and, just as the streams and rivers anticipated water distribution systems, so tanks, cisterns and reservoirs have their natural counterparts in water-holes and natural pools.

Throughout history people have devised systems to make getting and using water more convenient. Long after man had found ways and means to organize water supplies, find them where they were hidden and lead them to where he wanted them, streams and pools in their natural state has served as communal water supplies, even in more or less civilized Europe.

Early Rome had indoor plumbing, meaning a system of aqueducts and pipes that terminated in homes and at public wells and fountains for people to use.

London water supply infrastructure developed over many centuries from early mediaeval conduits, through major 19th century treatment works built in response to cholera threats, to modern large scale reservoirs.Many of the so-called "wells" of medieval Britain, for example, were untouched pools or gushing springs. The same applies of course to a great many "wells of the East" and in all writings the term "well" may not mean a dug well at all but a surface pool adopted as a communal or regular water supply.

The history of conduits or public fountains as communal water supplies starts at least as far back as the 13$^{th}$ century. In the "conduit age"- the centuries immediately following the Middle Ages a water carrier was a common sight.

The 17$^{th}$ century marks the beginning of the new order in communal organization and in relation to water supply, the beginning of large-scale schemes.

All through London's history until modern times, the question of water supply continued to be a problem. In the 18$^{th}$ century even with the appearance of larger water companies the water supply was far from being satisfactory. It was a usual practice at the time to lay on water for two hours every day.

At York, before the formation of the present water company in 1846 one half of the city was supplied for 2 hours on Mondays, Wednesdays and Fridays and the other half on Tuesdays, Thursdays and Saturdays, no supply being given on Sundays.

Water drawn from the river Thames was in a state that was offensive to the sight as the intake was found to be only three yards from the outlet of a great sewer. As a matter of fact it took 2 outbreaks of cholera to pass a Bill for an improved water supply in the middle of the 19$^{th}$ century.

In spite of the progress made in the field of water supply in many countries, there is much to be done yet. In Asia and Africa outside the great cities, methods are primitive as ever they were; village ponds are still used in Africa and Asia for drinking, washing and bathing and as watering places for cattle, in Madagascar in recent years people have had to carry their water bottles several miles and, as some of them can only do the journey twice a week, they have trained themselves to do with the minimum of water, drinking only on alternative days and never washing during a drought.

***1. a)What do the following numbers refer to?***

2, 13, 18, 17, 2, 19.

***b) Make out questions to which these numbers are answers.***

***2. Answer the questions:***

1. What was the first water supply system in Early Rome?
2. What was the situation in London?
3. Was there a great difference between the water supply systems in the $17^{th}$ and $18^{th}$ centuries?
4. When was the first water supply company established in York?
5. Why water supply systems in the countries of Asia and Africa are so undeveloped?

**3. Fill in the gaps with the words:**

*wells, Madagascar , devices, indoor plumbing, fountains, infrastructure , methods*

1. Early Rome had _____meaning a system of aqueducts and pipes that terminated in homes and at public_____ and _____for people to use.
2. Nature has provided prototypes for most of man's_____.
3. London water supply _____ developed over many centuries from early medieval conduits.
4. In Asia and Africa outside the great cities _____are primitive as ever they were.
5. In _____in recent years people have had to carry their water bottles several miles.

# UNIT 4

# WATER TREATMENT

## Water Treatment

***Match the words with their Russian equivalents:***

| | |
|---|---|
| 1. disinfection | A. марганец |
| 2. coagulation | B. передача, перевозка |
| 3. sludge | C. свёртывание |
| 4. substances | D. гриб |
| 5. algae | E. вещество |
| 6. fungi | F. дезинфекция |
| 7. manganese | G. аэрация, проветривание |
| 8. conveyance | H. водоросль |
| 9. requirements | I. требования |
| 10. aeration | J. грязь, ил, осадок |

Water treatment describes those processes used to make water more acceptable for a desired end-use. These can include use as drinking water, industrial processes, medical and many other uses. The goal of all water treatment process is to remove existing contaminants in the water, or reduce the concentration of such contaminants so the water becomes fit for its desired end-use. One such use is returning water that has been used back into the natural environment without adverse ecological impact.

The processes involved in treating water for drinking purpose may be solids separation using physical such as settling and filtration, chemical such as disinfection and coagulation. Biological processes are also employed in the treatment of wastewater.

Sedimentation in potable water treatment generally follows a step of chemical coagulation and flocculation, which allows grouping particles together into flock of a bigger size. Sedimentation is a physical water treatment process used to settle out suspended solids in water under the influence of gravity. Sedimentation tanks can be of different shapes, often rectangular or circular. They are sized in order to have an optimal sedimentation speed. If sedimentation speed is too high, most particles will

not have sufficient time to settle, and will be carried with the treated water. If the speed is too low, the tanks will be of an excessive size.

Water purification is the removal of contaminants from untreated water to produce drinking water that is pure enough for its intended use, most commonly human consumption. Substances that are removed during the process of drinking water treatment include bacteria, algae, viruses, fungi, minerals such as iron, manganese and sulphur, and man-made chemical pollutants including fertilizers.

It is important to take measures to make available water of desirable quality at the consumer end. That leads to protection of the treated water during conveyance and distribution after treatment. It is common practice to have residual disinfectants in the treated water in order to kill any bacteriological contamination after water treatment.

The combination of following processes is used for municipal drinking water treatment worldwide: *pre-chlorination*, *aeration, coagulation, sedimentation*, *filtration, disinfection*.

There is no unique solution for any type of water. Also, it is difficult to standardize the solution in the form of processes for water from different sources.

World Health Organization (WHO) guidelines are generally followed throughout the world for drinking water quality requirements. In addition of the WHO guidelines, each country or territory or water supply body can have their own guidelines in order for consumers to have access to safe drinking water.

***1. Match the words with the definitions:***

| | |
|---|---|
| Pre-chlorination | physical water treatment process used to settle out suspended solids in water |
| Filtration | for removal of dissolved iron and manganese |
| Disinfection | grouping particles together into flock |
| Aeration | for algae control and arresting any biological growth |
| Sedimentation | the removal of contaminants from untreated water |
| Water purification | killing bacteria |
| flocculation | solids separation |

***2. Answer the questions:***

1.What is the goal of a water treatment process?

2. What types of water treatment do scientists use to purify water?

3. What is sedimentation?

4. Are there many substances removed during the process of drinking water treatment? What are they?

5. What processes are used for municipal drinking water treatment worldwide?

6. Why it is difficult to standardize the solution for water from different sources?

7. What is the goal of filtration in the process of water purification?

8. What is the goal of coagulation in the process of water purification?

***3. Fill in the gaps:***

*settling, acceptable, filtration, shapes, substances, remove, solution, disinfection, coagulation.*

1. Water treatment describes those processes used to make water more_____

2. The goal of all water treatment process is to _____existing contaminants in the water.

3. The processes involved in treating water for drinking purpose may be solids separation using physical such as_____, chemical such as _____.

4. Sedimentation tanks can be of different_____, often rectangular or circular.

5. _____that are removed during the process of drinking water treatment include bacteria, algae, viruses, fungi, minerals such as iron, manganese and sulphur, and man-made chemical pollutants including fertilizers.

6. There is no unique_____ for any type of water.

**Desalination**

As new technological innovations continue to reduce the capital cost of desalination, more countries are building desalination plants as a small element in addressing their water crises.

- Israel desalinizes water for a cost of 53 cents per cubic meter

- Singapore desalinizes water for 49 cents per cubic meter and also treats sewage with reverse osmosis for industrial and potable use.

- China and India, the world's two most populous countries, are turning to desalination to provide a small part of their water needs.

- In 2007 Pakistan announced plans to use desalination.

- Australia uses desalination.

- In 2007 Bermuda signed a contract to purchase a desalination plant.

- The largest desalination plant in the United States is the one at Tampa Bay, Florida, which began desalinizing 95000 $m^3$ of water per day in December 2007.

- After being desalinized at Jubal, Saudi Arabia, water is pumped 320 km inland though a pipeline to the capital city of Riyadh.

- The world's largest desalination plant is the Jebel Ali Desalination Plant in the United Arab Emirates.

It is a dual-purpose facility that uses multi-stage flash distillation and is capable of producing 300 million cubic meters of water per year. Irrigable lands, population, technicalities of projects define needs. A regional approach focuses on satisfying individuals with their need of water, ensures that minimum quantitative needs are being met. It removes the conflict that arises when countries view the treaty from a national interest point of view. Although water crisis is closely related to regional tensions, history showed that the 37 records of acute conflict over water are far less than the record of cooperation. In the last 50 years 157 treaties were signed, 1,288 crises turned out to be a co-operative opportunities.

The key lies in strong institutions and cooperation. Formation of strong international institutions seems to be a way forward.

***1. Answer the questions:***

1. What is desalination?
2. Is desalination closely related to water crisis?
3. Which countries build plants to use desalination?
4. Do countries cooperate solving the water crisis problem?
5. Where is the world's largest desalination plant?

***2. Put the words in to the gaps:***

1. The world's largest desalination plant is in_____.

2._____, the world's two most populous countries, are turning to desalination to provide a small part of their water needs.

3. In 2007 _____ announced plans to use desalination.

4. In 2007 Bermuda signed a contract to_____.

5. After being desalinized water is pumped 320 km inland through _____ to the capital city of Riyadh.

6. Formation of _____seems to be a way forward.

7. A regional approach focuses on _____individuals with their need of water.

8. Israel desalinizes water for _____ of 53 cents per cubic meter.

9. Singapore _____ water for 49 cents per cubic meter and also treats sewage for _____ use.

10. The _____in the United States is the one at Tampa Bay, Florida.

**Industrial water treatment**

Water treatment is used to optimize most water-based industrial processes, such as: heating, cooling, processing, cleaning, and rinsing, so that operating costs and risks are reduced. Poor water treatment lets water interact with the surfaces of pipes and vessels which contain it. Steam boilers can scale up or corrode, and these deposits will mean more fuel is needed to heat the same amount of water. Cooling towers can also scale up and corrode, the warm, dirty water they can contain will encourage bacteria to grow. Domestic water can become unsafe to drink if proper hygiene measures are neglected.

In many cases, effluent water from one process might be perfectly suitable for reuse in another process somewhere else on site. With the proper treatment, a significant proportion of industrial on-site wastewater might be reusable. This can save money in three ways: lower charges for lower water consumption, lower charges for the smaller volume of effluent water discharged and lower energy costs due to the recovery of heat in recycled wastewater.

Industrial water treatment seeks to manage four main problem areas: scaling, corrosion, microbiological activity and disposal of residual wastewater. Boilers do

not have many problems with microbes as the high temperatures prevent their growth.

Scaling occurs when the chemistry and temperature conditions are such that the dissolved mineral salts in the water are caused to precipitate and form solid crystalline deposits. Scale is a problem because it insulates and heat exchange becomes less efficient as the scale thickens, which wastes energy. Scale also narrows pipe widths and therefore increases the energy used in pumping the water through the pipes.

Corrosion occurs when the parent metal oxidizes (as iron rusts, for example) and gradually the integrity of the plant equipment is compromised. The corrosion products can cause similar problems to scale, but corrosion can also lead to leaks, which in a pressurized system can lead to catastrophic failures.

Microbes can thrive in untreated cooling water, which is warm and sometimes full of organic nutrients. Dusts, flies, grass, fungal spores and so on collect in the water and create a sort of "microbial soup" if not treated with biocides.

Disposal of residual wastewaters from an industrial plant is a difficult and costly problem. Most petroleum refineries, chemical and petrochemical plants have onsite facilities to treat their wastewaters so that the pollutant concentrations in the treated wastewater comply with the local and/or national regulations regarding disposal of wastewaters into community treatment plants or into rivers, lakes or oceans.

Industrial wastewater treatment covers the mechanisms and processes used to treat waters that have been contaminated in some way by industrial or commercial activities prior to its release into the environment or its re-use. Most industries produce some wet waste although recent trends in the developed world have been to minimize such production or recycle such waste within the production process. However, many industries remain dependent on processes that produce wastewaters.

The production of iron from its ores involves powerful reduction reactions in blast furnaces. Cooling waters are inevitably contaminated with products especially cyanide. Production of coke from coal also requires water cooling and the use of water in by-products separation. Contamination of waste streams includes

gasification products such as benzene, cyanide, ammonia, phenols together with a range of more complex organic compounds.

The conversion of iron or steel into sheet, wire or rods requires hot and cold mechanical transformation stages frequently employing water as a lubricant and coolant.

Wastewater generated from agricultural and food operations has distinctive characteristics that set it apart from common municipal wastewater managed by public or private wastewater treatment plants throughout the world: it is biodegradable and nontoxic, but that has high concentrations of biochemical oxygen demand and suspended solids. Processing food for sale produces wastes generated from cooking which are often rich in plant organic material and may also contain salt, flavourings, colouring material and acids or alkali. Very significant quantities of oil or fats may also be present.

A range of industries manufacture or use complex organic chemicals. These include pesticides, pharmaceuticals, paints and dyes, petro-chemicals, detergents, plastics, paper pollution. Waste waters can be contaminated by by-products, product material in soluble or particulate form, washing and cleaning agents, solvents.

Water treatment for the production of drinking water is dealt with elsewhere. Many industries have a need to treat water to obtain very high quality water for demanding purposes. The different types of contamination of wastewater require a variety of strategies to remove the contamination.

The wastewaters from large-scale industries such as oil refineries, petrochemical plants, chemical plants, and natural gas processing plants commonly contain gross amounts of oil and suspended solids. Those industries use a device known as an oil-water separator which is designed to separate the oil and suspended solids from their wastewater effluents.

***1. Give Russian equivalents to the words:***

*water consumption, scaling, corrosion, microbiological activity, recycle, ammonia, fungal spores, flavourings, petrochemical plants, metal oxidizes, biodegradable, oil refineries.*

***2. Answer the questions:***

1. Where is industrial water treatment used?
2. Does the proper treatment of water save money? In what way?
3. Which main areas industrial water treatment seeks to manage?
4. What is scaling?
5. What is corrosion?
6. How many manufactures solve the problem of residual wastewater?
7. Which distinctive characteristics wastewater generated from agricultural and food operations has?

***3. Complete the sentences, using the text:***

1. Scale is a problem because it _____.
2. The corrosion products can cause_____.
3. Many industries have a need to treat_____.
4. A range of industries manufacture or use complex organic_____.
5. The production of iron from its ores involves_____.
6. Disposal of residual wastewaters from an industrial plant is_____.
7. Poor water treatment lets water_____.
8. Domestic water can become unsafe to drink_____.
9. Proper water treatment can save money in three ways:_____.
10. The industries use a device known as an oil-water separator which is designed to separate_____.

***4. Mark the following statements as True or False:***

1. Water treatment is used to minimize most water-based industrial processes.
2. Wastewater generated from agricultural and a food operation is biodegradable and nontoxic.
3. Many industries have a need to treat water to obtain very high quality potable water.
4. Waste waters can be contaminated by solvents.
5. Organic chemicals include pesticides, pharmaceuticals, paints and dyes, petro-chemicals, detergents, plastics, paper pollution.

# UNIT 5

# WASTEWATER

## Wastewater. Origins of Wastewater

1) Wastewater is any water that has been adversely affected in quality by anthropogenic influence. It comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture and can encompass a wide range of potential contaminants and concentrations. In the most common usage, it refers to the municipal wastewater that contains a broad spectrum of contaminants resulting from the mixing of wastewaters from different sources.

2) Wastewater or sewage can come from:

*Human waste:* so called *black water* from lavatories; sewage treatment plant discharge; washing water, rainfall collected on roofs, yards.

*Industrial waste:* industrial site drainage, industrial process waters, organic, inorganic , extreme pH, agricultural drainage.

3) The composition of wastewater varies widely. This is a partial list of what it may contain: water ( > 95%), pathogens, organic particles, inorganic particles, soluble inorganic material, animals, gases, emulsions, toxins.

4) Some industrial facilities generate ordinary domestic sewage that can be treated by municipal facilities. Industries that generate wastewater with high concentrations of conventional pollutants, toxic pollutants or other nonconventional pollutants such as ammonia need specialized treatment systems. Some of these facilities can install a pre-treatment system to remove the toxic components, and then send the partially-treated wastewater to the municipal system. Industries generating large volumes of wastewater typically operate their own complete on-site treatment systems.

Some industries have been successful at redesigning their manufacturing processes to reduce or eliminate pollutants, through a process called pollution prevention.

5) Sedimentation is often used as a primary stage in modern waste water treatment plant. Due to the large amount of reagent necessary to treat domestic

wastewater, preliminary chemical coagulation and flocculation are generally not used, remaining suspended solids being reduced by following stages of the system.

6) Sediment (loose soil) washed off fields is the largest source of agricultural pollution in the United States. Farmers may utilize erosion controls to reduce runoff flows and retain soil on their fields. Common techniques include contour plowing, crop mulching, crop rotation, planting perennial crops and installing riparian buffers.

7) Nutrients (nitrogen and phosphorus) are typically applied to farmland as commercial fertilizer. Nutrients may also enter runoff from crop residues, irrigation water, wildlife, and atmospheric deposition. Farmers can develop and implement nutrient management plans to reduce excess application of nutrients.

***1. Arrange the paragraph titles in the right order:***

A. Agricultural wastewater.

B. Nutrient management.

C. Waste Water Treatment.

D. Wastewater constituents.

E. Wastewater origin.

F. Industrial wastewater.

G. Sedimentation.

***2. Answer the questions:***

1. What is wastewater?
2. What does wastewater consist of?
3. What is an origin of wastewater?
4. What do you know about nutrients?
5. What do some plants do to treat wastewater?

***3. Match the following pollutants with their groups:***

| | |
|---|---|
| Pathogens | protozoa, insects, arthropods, small fish |
| Gases | paints, adhesives, mayonnaise, hair colourants |
| Emulsions | hairs, food, paper, plant materials |
| Organic particles | sand, metal particles, ceramics |

| | |
|---|---|
| Toxins | hydrogen sulphide, carbon dioxide, methane |
| Animals | ammonia, road-salt, sea-salt |
| Soluble inorganic material | bacteria, viruses and parasitic worms |
| Inorganic particles | pesticides, poisons, herbicides. |

**Sewage.**

Sewage is created by residences, institutions and commercial and industrial establishments. Raw sewage includes household waste liquid from toilets, baths, showers, kitchens, sinks that is disposed of via sewers. In many areas, sewage also includes liquid waste from industry and commerce.

The separation and draining of household waste into grey water and black water is becoming more common in the developed world, with grey water being permitted to be used for watering plants or recycled for flushing toilets. Municipal wastewater therefore includes residential, commercial, and industrial liquid waste discharges, and may include storm water runoff.

Domestic sewage is 99.9% pure water; the other 1% is pollutants. These pollutants although small, pose risk on a large scale. In urban areas, domestic sewage is typically treated by centralized sewage treatment plants. In the U.S., most of these plants are operated by local government agencies. Municipal treatment plants are designed to control conventional pollutants. Well-designed and operated systems can remove 90 percent or more of these pollutants. Some plants have additional sub-systems to treat nutrients and pathogens. Most municipal plants are not designed to treat toxic pollutants found in industrial wastewater.

Sewage systems capable of handling storm water are known as combined systems or combined sewers. Such systems are usually avoided since they complicate and thereby reduce the efficiency of sewage treatment plants owing to their seasonality. The variability in flow also leads to often larger than necessary, and subsequently more expensive, treatment facilities. In addition, heavy storms that contribute more flows than the treatment plant can handle may overwhelm the sewage treatment system, causing a spill or overflow. It is preferable to have a

separate storm drain system for storm water in areas that are developed with sewer systems.

As rainfall runs over the surface of roofs and the ground, it may pick up various contaminants including soil particles and other sediment, heavy metals, organic compounds, animal waste, and oil and grease. Examples of treatment processes used for storm water include sedimentation basins, wetlands, buried concrete vaults with various kinds of filters, and vortex separators.

***1. Answer the questions:***

1. How sewage is created?
2. What does raw sewage consist of?
3. What is a combined sewer?
4. Do you know the examples of treatment processes used for storm water?

***2. Match the words with their definitions:***

| | |
|---|---|
| organic compounds | to pass a substance through a system again for further treatment |
| contaminate | the precipitation in the form of raindrops |
| sewage | relating to living plants or animals |
| rainfall | any combination of two or more parts |
| compound | to make impure by touching or mixing, pollute |
| recycle | waste matter from domestic or industrial establishments |

***3. Complete the sentences:***

1. Sewage is created by_____
2. Raw sewage includes_____
3. The separation and draining of household waste into grey water and black water is becoming _____
4. It is preferable to have a separate storm drain system for_____
5. Sewage systems capable of_____
6. Municipal wastewater therefore includes_____
7. Sewage also includes liquid waste from_____

***4. Fill in the gaps with the words:***

*septic, sewage, pollutants, employ, control*

1. Well-designed and operated systems can remove 90 percent or more of the_____.

2. Domestic sewage is typically treated by centralized_____ treatment plants.

3. Municipal treatment plants are designed to _____ conventional pollutants.

4. A household or business not served by a municipal treatment plant may have an individual_____ tank, which treats the wastewater on site and discharges into the soil.

5. Cities with sanitary sewer overflow _____one or more engineering approaches to reduce discharges of untreated sewage.

**Sewage treatment. Process overview.**

Sewage treatment, or domestic wastewater treatment, is the process of removing contaminants from wastewater and household sewage, both runoff and domestic. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce a waste stream and a solid waste or sludge suitable for discharge or reuse back into the environment. This material is often contaminated with many toxic organic and inorganic compounds.

To be effective, sewage must be conveyed to a treatment plant by appropriate pipes and infrastructure and the process itself must be subject to regulation and controls. Some wastewaters require different and sometimes specialized treatment methods. At the simplest level, treatment of sewage and most wastewaters is carried out through separation of solids from liquids, usually by settlement. By progressively converting dissolved material into solids, usually a biological flock which is then settled out, an effluent stream of increasing purity is produced.

Sewage can be treated close to where it is created, or collected and transported via a network of pipes and pump stations to a municipal treatment plant. Sewage collection and treatment is typically subject to local, state and federal regulations and standards. Industrial sources of wastewater often require specialized treatment

processes. Conventional sewage treatment may involve three stages, called primary, secondary and tertiary treatment**.**

*Primary treatment* consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment.

*Secondary treatment* removes dissolved and suspended biological matter. Secondary treatment is typically performed by indigenous, water-borne micro-organisms in a managed habitat. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.

*Tertiary treatment* is sometimes defined as anything more than primary and secondary treatment. Treated water is sometimes disinfected chemically or physically prior to discharge into a stream, river, bay, lagoon or wetland, or it can be used for the irrigation of a golf course, green way or park. If it is sufficiently clean, it can also be used for groundwater recharge or agricultural purposes.

As of 2006, waterborne diseases are estimated to cause 1.8 million deaths each year. These deaths are attributable to inadequate public sanitation systems and it is clear that proper sewerage need to be installed**.**

Appropriate technology options in water treatment include both community-scale and household-scale point-of-use designs.

In order for the decrease of waterborne diseases to have long term effects, water treatment programs implemented by research and development groups in developing countries must be sustainable by its own residents. This can ensure the efficiency of such programs after the departure of the research team as monitoring is difficult because of the remoteness of many locations.

***1. Answer the questions:***

1. What is a sewage treatment?
2. What is the goal of this process?
3. What is a way to make sewage less dangerous for nature?

4. How many stages may conventional sewage treatment involve?

5. What is the reason for waterborne diseases to appear?

***2. Fill in the gaps in the sentences, using the correct form of the verbs:***

*to convey, to call, to estimate, to require, to disinfect, to contaminate, to remove*

1. Waterborne diseases _____to cause 1.8 million deaths each year.

2. Secondary treatment _____dissolved and suspended biological matter**.**

3. Conventional sewage treatment may involve three stages, _____primary, secondary and tertiary treatment.

4. Some wastewaters different and sometimes specialized treatment methods.

5. This material often _____ with many toxic organic and inorganic compounds.

6. To be effective, sewage must be _____ to a treatment plant.

7. Treated water sometimes _____ chemically or physically.

***3. Decide whether the following statements are true or false, correct those ones which are false.***

1. Secondary treatment is sometimes defined as anything more than primary and secondary treatment.

2. Sewage treatment includes just chemical and biological processes.

3. Conventional sewage treatment may involve three stages, called primary, secondary and tertiary treatment.

4. Treated water can be used for the irrigation of a golf course, green way or park. 5. In order for the decrease of waterborne diseases to have long term effects, water treatment programs can be ignored by the residents.

6. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge.

7. The government should regulate and control the process of sewage treatment.

8. If treated water is sufficiently clean, it can be used for agricultural purposes.

9. Sewage must be transported to a treatment plant by appropriate pipes and infrastructure.

10. Appropriate technology options in water treatment include tree designs.

## Sedimentation stages.

***Match the following words with their Russian equivalents.***

| | |
|---|---|
| 1. tank | A. простейшие (микроорганизмы) |
| 2. grease | B. растворимый |
| 3. homogeneous liquid | C. смазочные вещества |
| 4. mechanically driven scrapers | D. резервуар |
| 5. saponification | E. осаждение, отложение осадка |
| 6. biological content | F. омыление |
| 7. biota | G.флора и фауна определённого района |
| 8. soluble | H. однородная жидкость |
| 9. protozoa | I. Разлагаемый |
| 10.biodegradable | J. механические грейдеры (скребки) |
| 11.sedimentation | K. биологический состав |

In the primary sedimentation stage, sewage flows through large tanks, commonly called "primary clarifiers" or "primary sedimentation tanks". The tanks are large enough that sludge can settle and floating material such as grease and oils can rise to the surface and be skimmed off. The main purpose of the primary sedimentation stage is to produce both a generally homogeneous liquid capable of being treated biologically and a sludge that can be separately treated or processed. Primary settling tanks are usually equipped with mechanically driven scrapers that continually drive the collected sludge towards a hopper in the base of the tank from where it can be pumped to further sludge treatment stages. Grease and oil from the floating material can sometimes be recovered for saponification.

Secondary treatment is designed to substantially degrade the biological content of the sewage such as are derived from human waste, food waste, soaps and detergent. The majority of municipal plants treat the settled sewage liquor using aerobic biological processes. For this to be effective, the biota requires both oxygen and a substrate on which to live. There are a number of ways in which this is done. In all these methods, the bacteria and protozoa consume biodegradable soluble organic

contaminants (sugars, fats, organic short-chain carbon molecules) and bind much of the less soluble fractions into floc.

The purpose of tertiary treatment is to provide a final treatment stage to raise the effluent quality before it is discharged to the receiving environment (sea, river, lake, ground). More than one tertiary treatment process may be used at any treatment plant. If disinfection is practiced, it is always the final process.

**1. Answer the questions:**

1. What is the main purpose of the primary sedimentation stage?
2. Why the tanks for the primary treatment should be of the large size?
3. How are the primary settling tanks usually equipped?
4. What is the main purpose of the secondary sedimentation stage?
5. Which way do the majority of municipal plants treat the settled sewage liquor?
6. What is the main purpose of tertiary treatment?
7. What biodegradable soluble organic contaminants do you know?

***2. Fill in the gaps:***

1. In the primary sedimentation stage, sewage flows through large tanks, commonly called _____ or _____.
2. The main purpose of the primary sedimentation stage is _____ both a generally homogeneous liquid and a sludge.
3. Grease and oil from the floating material can sometimes be recovered _____.
4. Secondary treatment is designed to substantially degrade the biological content of the sewage such as _____.
5. The biota requires both _____ and _____ on which to live.
6. The soluble organic contaminants are _____.
7. The receiving environment is _____.
8. If _____ is practiced, it is always the final process.

***3. Try to define which stage of sedimentation these words are belong to:***

| *Treatment* | *Process* |
|---|---|
| primary | biodegradable, floc, human waste, aerobic biological processes, biota, oxygen, biological content |
| secondary | disinfection, final, effluent, discharge |
| tertiary | tanks, sludge, scrapers, homogeneous, floating material, saponification |

**Disinfection.**

The purpose of disinfection in the treatment of wastewater is to substantially reduce the number of microorganisms in the water to be discharged back into the environment. The effectiveness of disinfection depends on the quality of the water being treated (cloudiness, pH), the type of disinfection being used, the disinfectant dosage (concentration and time), and other environmental variables. Cloudy water will be treated less successfully since solid matter can shield organisms, especially from ultraviolet light or if contact times are low. Generally, short contact times, low doses and high flows all militate against effective disinfection. Common methods of disinfection include ozone, chlorine, or ultraviolet light.

Chlorination remains the most common form of wastewater disinfection in North America due to its low cost and long-term history of effectiveness.

Ultraviolet (UV) light can be used instead of chlorine, iodine, or other chemicals. Because no chemicals are used, the treated water has no adverse effect on organisms that later consume it, as may be the case with other methods. UV radiation causes damage to the genetic structure of bacteria, viruses, and other pathogens, making them incapable of reproduction. The key disadvantages of UV disinfection are the need for frequent lamp maintenance and replacement and the need for a highly treated effluent to ensure that the target microorganisms are not shielded from the UV radiation. In the United Kingdom, light is becoming the most common means of disinfection because of the concerns about the impacts of chlorine in chlorinating residual organics in the wastewater and in chlorinating organics in the receiving water.

***1. Answer the questions:***

1. What is the purpose of disinfection?
2. What does the effectiveness of disinfection depend on?
3. What parameters does a disinfectant dosage contain of?
4. Ozone, chlorine, or ultraviolet light are the common methods of disinfection, aren`t they?
5. Why does chlorination remain the most common form of wastewater disinfection in North America?
6. What are the key disadvantages of UV disinfection?
7. Why in the United Kingdom scientists prefer light as the most common means of disinfection?

***2. Complete the sentences:***

1. The purpose of disinfection in the treatment of wastewater is _____.
2. The effectiveness of disinfection depends on _____ .
3. The disinfectant dosage is _____ .
4. Common methods of disinfection include _____ .
5. Chlorination remains the most common form of wastewater disinfection in North America due _____ .
6. Ultraviolet (UV) light can be used instead of _____ .
7. UV radiation causes damage to _____ .
8. The key disadvantages of UV disinfection are _____ .
9. In the United Kingdom, light is becoming the most common means of disinfection because of _____.

**Water Treatment Situations In Different Countries.**

In the US and EU, uncontrolled discharges of wastewater to the environment are not permitted under law, and strict water quality requirements are to be met.

A significant threat in the coming decades will be the increasing uncontrolled discharges of wastewater within rapidly developing countries. In many developing countries the bulk of domestic and industrial wastewater is discharged without any treatment or after primary treatment only. In Latin America about 15% of collected

wastewater passes through treatment plants. In Venezuela, 97 percent of the country's sewage is discharged raw into the environment.

In a relatively developed Middle Eastern country such as Iran, Tehran's majority of population has totally untreated sewage injected to the city's groundwater. In Israel, about 50 percent of agricultural water usage is provided through reclaimed sewer water. Future plans call for increased use of treated sewer water as well as more desalination plants.

Most of sub-Saharan Africa is without wastewater treatment.

Water utilities in developing countries are chronically underfunded because of low water tariffs, the inexistence of sanitation tariffs in many cases, low billing efficiency and low quality operational efficiency. In addition, wastewater treatment typically is the process within the utility that receives the least attention, partly because enforcement of environmental standards is poor. As a result of all these factors, operation and maintenance of many wastewater treatment plants is poor. Developing countries as diverse as Egypt, Algeria, China or Colombia have invested substantial sums in wastewater treatment without achieving a significant impact in terms of environmental improvement.

***1. Answer the questions:***

1. Is there any difference between the highly developed countries and developing ones in utility of wastewater?
2. Why do you think the bulk of domestic and industrial wastewater is discharged without any treatment in many developing countries?
3. In which Latin country the situation with discharging wastewater into the environment is the worst?
4. Why water utilities in developing countries are dramatically underfunded?
5. Which developing countries have made a progress investing substantial sums in wastewater treatment?

***2. Decide whether the following statements are true or false, correct those ones which are false.***

1. In Latin America about 15% of collected wastewater is discharged into the environment.
2. Operation and maintenance of many wastewater treatment plants in developing countries is poor.
3. In Israel, about 50 percent of agricultural water usage is injected to the city's groundwater.
4. Israel tends to maintain the enterprises for desalination of water.
5. Most of sub-Saharan Africa is with perfect wastewater treatment.

***3. Make a short report about the wastewater treatment situation in your own country.***

## UNIT 6

## SEWERAGE

### Sewerage

The problem of protecting natural water resources has grown very pressing for many countries since the beginning of the second half of the 20$^{th}$ century. The development of human society, the growth of civilization and social and technical progress has resulted in the changing of the composition of natural water resources. The rivers, lakes and ground waters contain today a considerable amount of the products of mechanical, chemical and biological pollution.

"Sewage" includes domestic, municipal, or industrial liquid waste products disposed of, usually via a pipe or sewer or similar structure. The physical infrastructure, including pipes, pumps and channels used to convey sewage from its origin to the point of eventual treatment or disposal is termed sewerage. In the past the word "sewage" also meant what is now called "sewerage". Possibly because of that, the word "sewerage" is often mistakenly used to mean "sewage".

The waste products that result from the daily activities in a community are of two general types: namely, the liquid waste, known as sewage and the solid wastes, known as refuse. The different wastes of which sewage is composed are the following: the wastes from lavatories, baths, sinks, and laundry tanks in residences,

institutions, and business buildings; certain liquid wastes from various types of manufacturing or industrial plants, and, in many communities, the surface run-off that results from storms or street flushing operations.

Sewage may also be divided according to its source into the following three classes. The sewage from residences, institutions and business buildings is called domestic sewage, sanitary sewage or house sewage; that resulting from manufacturing or industrial processes is known as industrial waste; and that form run-off during or immediately following storms is called storm sewage. A combination of domestic sewage, industrial waste and storm water is called combined sewage.

Both sewage and refuse must be removed promptly in order to avoid endangering the health of the community and also prevent decomposition of the materials of animal or vegetable origin and the subsequent production of nuisances and odours.

The removal of all kinds of sewage is usually accomplished by means of sewers. The sewers are placed in the streets at several feet below the ground surface. The general process of removing sewage is designated as sewerage and the entire systems of sewers including a sewage treatment plant are known as a sewerage system.

The method of sewage treatment to be adopted in a particular case will depend almost entirely on local conditions. It may consist only of the discharge of the raw sewage into a stream or a large body of water. The usual methods of sewage treatment consist either of preliminary treatment alone or of primary treatment followed by secondary treatment.

During primary treatment the larger and heavier solid particles settle out from the liquid. These solid particles that settle out form a slimy paste which is known as sludge.

The partly clarified sewage that has been given primary treatment generally contains much decomposable materials. Therefore, further treatment which may be used with either primary or secondary treatment is disinfection or the killing of the most of the bacteria in the sewage by means of chemicals.

***1. Answer the questions:***

1. Is there any difference between the words "sewerage" and "sewage"?

2. Has the composition of natural water resources remained the same since the ancient time?

3. What kind of products does modern sewerage include?

4. What does sewerage system contain of?

5. What are the different wastes of which sewage is composed?

6. What is the difference between the sewage and refuse?

7. What is a sewerage system?

8. What are the usual methods of sewage treatment?

9. Why disinfection is used for while treating the waste?

10. The method of sewage treatment will depend almost entirely on local conditions, won`t it?

***2. Fill in the gaps:***

1. The rivers, lakes and ground waters contain today a considerable amount of the products of_____, _____ and _____ pollution.

2. The physical infrastructure used to convey sewage from its origin to the point of eventual treatment or disposal is termed_____.

3. The waste products that result from the daily activities in a community are of _____ general types: the _____ waste, known as sewage and the solid wastes, known as_____.

4. Sewage may also be divided according to its _____ into the following three_____.

5. The sewage resulting from manufacturing or industrial processes is known as _____waste.

6. A _____ of domestic sewage, industrial waste and storm water is called _____sewage.

7. The general process of removing sewage is designated as _____ and the entire systems of sewers including a sewage treatment plant are known as a_____.

8. The usual methods of sewage treatment consist either of preliminary treatment alone or of primary treatment followed by_____ _____.

9. The solid particles that settle out form a slimy paste which is known as_____.

10. The most of the bacteria in the sewage are killed by means of_____.

***3. Decide whether the following statements are true or false, correct those ones which are false.***

1. The problem of protecting natural water resources has grown very pressing for many countries since the beginning of the second half of the last century.

2. Solid waste products disposed of usually via a pipe.

3. The products of mechanical, chemical and biological pollution are discharged into the environment.

4. The rivers, lakes and ground waters are not contaminated very much today.

5. Sewerage is the chemical infrastructure.

6. Sewage may also be divided according to its source into several classes.

7. The method of sewage treatment to be adopted in a particular case is the same in any situation.

8. Sewerage system is the entire systems of sewers including a sewage treatment plant.

## From the History of Sewerage

Man's sewerage practice has been known from ancient times. Explorations revealed sewers in Babylon dating from the 17$^{th}$ century before our era. Considerable information is available about the sewers of Jerusalem, works of this class in ancient Greek cities are fairly well known and the great underground drains of Rome have repeatedly been described.

The history of the progress of sanitation in London probably affords a typical picture of what took place quite generally about the middle of the 19$^{th}$ century in the largest cities of Great Britain and the United States. Well into the 19$^{th}$ century while London outgrew the narrow limits of the city proper and its adjacent parishes and

became a great metropolis, the centre of the world's commerce, sanitation was as little considered as magnetism or the use of steam for power purposes.

The lack of central authority rendered a systematic study and execution of sewerage work impossible. As late as 1845 there was no survey of the metropolis adequate as a basis for planning sewers. The sewers in adjoining parishes were of different elevation so that a junction of them was impracticable.

But the strong feeling that good public health is a valuable municipal asset and depends largely upon good sewerage was the deciding factor in the growing popular recognition of the sanitary importance of a good sewerage system.

The first engineer who made a comprehensive study of metropolitan sewerage needs, thus described the conditions of London basement and cellars in 1847:"There are hundreds, I may say thousands of houses in this metropolis which have no drainage whatever and the greater part of them have stinking overflowing cesspools. And there are also hundreds of streets, courts and alleys that have no sewers". After 2 outbreaks of cholera a royal commission was appointed to inquire into sanitary improvements of London. In 1855 Parliament passed an act for the better local management of the metropolis which laid the basis for the sanitation of London.

In the continent of marked progress in sewerage began in 1842 when a severe fire destroyed the old part of the city of Hamburg. The portion ruined was the oldest and it was decided to rebuild it according to the modern ideas of convenience. As a result Hamburg was the first city which had a complete systematic sewerage system throughout built according to modern ideas. The system proved so well designed and maintained that twenty-five years after the sewers were completed they were found by a committee of experts to be clean and almost without odour.

At the present time the problem of good sanitation is closely connected with that of protecting the purity of natural water reservoirs, since often the same body of water must serve both as a source and as a recipient of sewage and storm drainage. And it is this dual use of water in nature and within communities and industrial premises that establishes the most impelling reasons for water sanitation.

The source of pollution lies largely in the effluents of industry, urban life, agricultural production and transport, the worst pollution being caused by the chemical industry. Modern agriculture which utilizes huge quantities of chemical fertilizers also pollutes the ground water and rivers.

Despite the growing improvement in water treatment methods many regions of the world cannot cope with the rapid rate of water contamination. The highly industrialized countries naturally suffer more than others. Certainly the conditions which existed only a century ago cannot be restored in present or future large cities. But we badly need to find new ways of using the water in industry and agriculture and of radically improving the technology of drainage purification.

***1. Choose the correct variant to complete the sentences:***

1. One of the main reasons for the backward condition of the sewerage system in London was…

a) that large sewers were made to discharge into small sewers.

b) that some of the sewers were higher than the cesspools which they were supposed to drain.

c) that there was no authority to make landlords connect their houses with sewers. d) that there were hundreds or even thousands of houses which were connected by great underground drains.

2. The sewers in adjoining parishes were of different elevation so…

a) sanitation was as little considered as the utilization of steam for power purposes.

b) a junction of them was impracticable.

c) the public recognition of the importance of good sewerage systems was growing.

d) there were hundreds of houses which had no drainage whatever.

3. After 2 outbreaks of cholera a royal commission was appointed…

a) to find new ways of water treatment.

b) to inquire into sanitary improvements for London.

c) to produce reports clearly showing the need for extensive sewerage works.

d) to make landlords connect their houses with sewers.

4. While London grew and became a great metropolis, the centre of the world's commerce,...

a) it was impracticable to make an adequate survey as a basis for planning sewers

b) the connection between a contaminated water supply and the spreading of diseases was evident.

c) sanitation was as little considered as magnetism or the use of steam for power purposes.

d) it was only a central authority that could make a systematic study of sewerage work possible.

5. Nowadays the problem of good sanitation is closely connected with that of protecting the purity of natural water reservoirs…

a) since the chemical industry causes the worst pollution.

b) since highly industrializes countries suffer greatly from water contamination.

c) since the same body of water serves both as a source of water and recipient of sewage and storm drainage.

d) since public health depends greatly on good sewerage.

***2. a) What do the following numbers refer to?***

*1842, 17th, 1847, 1855, 19th, 1845*

***b) Make out questions to which these numbers are answers.***

***3. Make up the summary of the text.***

**Regulatory Policy**

A great variety of institutions have responsibilities in water supply. A basic distinction is between institutions responsible for policy and regulation on the one hand; and institutions in charge of providing services on the other hand.

Dozens of countries around the world have established regulatory agencies for infrastructure services, including often water supply and sanitation, in order to better protect consumers and to improve efficiency. Regulatory agencies can be entrusted with a variety of responsibilities. They are supposed to be autonomous from the executive branch of government, but in many countries have often not been able to exercise a great degree of autonomy.

In the United States regulatory agencies for utilities have existed for almost a century at the level of states, and in Canada at the level of provinces. In many US states they are called Public Utility Commissions. For England and Wales, a regulatory agency for water was created as part of the privatization of the water industry in 1989.

In many developing countries, water regulatory agencies were created during the 1990s in parallel with efforts at increasing private sector participation.

Many countries do not have regulatory agencies for water. In these countries service providers are regulated directly by local government, or the national government. This is, for example, the case in the countries of continental Europe, in China and India.

Water supply policies and regulation are usually defined by one or several Ministries. In the United States Environmental Protection Agency, whose administrator reports directly to the President, is responsible for water and sanitation policy and standard setting within the executive branch. In other countries responsibility for sector policy is entrusted to a Ministry of Environment (such as in Mexico and Colombia), to a Ministry of Health (such as in Panama, Honduras and Uruguay), a Ministry of Public Works (such as in Ecuador and Haiti), a Ministry of Economy (such as in German states) or a Ministry of Energy (such as in Iran). A few countries, such as Jordan and Bolivia, even have a Ministry of Water. Often several Ministries share responsibilities for water supply. In the European Union, important policy functions have been entrusted to the supranational level.

Water supply providers can be public, private, mixed or cooperative. Most urban water supply services around the world are provided by public entities.

Water supply service providers, which are often utilities, differ from each other in terms of their geographical coverage relative to administrative boundaries; their sector coverage; their ownership structure; and their governance arrangements.

Many water utilities provide services in a single city, town or municipality. In some federal countries there are water service providers covering most or all cities and towns in an entire state, such as in all states of Brazil and some states in Mexico.

In England and Wales water supply and sewerage is supplied almost entirely through ten regional companies.

Some smaller countries, especially developed countries, have established service providers that cover the entire country or at least most of its cities and major towns. Such national service providers are especially prevalent in West Africa and Central America, but also exist, for example, in Tunisia, Jordan and Uruguay. In rural areas, where about half the world population lives, water services are often not provided by utilities, but by community-based organizations which usually cover one or sometimes several villages.

Some water utilities provide only water supply services, while sewerage is under the responsibility of a different entity. This is for example the case in Tunisia. However, in most cases water utilities also provide sewer and wastewater treatment services. In some cities or countries utilities also distribute electricity. In a few cases such multi-utilities also collect solid waste and provide local telephone services.

***1. Fill in the table writing down the country opposite the regulation agency it has:***

| **The agency** | **The country** |
|---|---|
| a Ministry of Health | |
| a Ministry of Water | |
| a Ministry of Public Works | |
| a Ministry of Economy | |
| a Ministry of Energy | |
| an Environmental Protection Agency | |
| a Ministry of Environment | |

## UNIT 7

## POLLUTION

### Pollution. Forms of Pollution

Pollution is the introduction of contaminants into an environment that causes instability, disorder, harm or discomfort to the ecosystem: physical systems or living organisms. Pollution can take the form of chemical substances, or energy, such as

noise, heat, or light. Pollutants, the elements of pollution, can be foreign substances or energies, or naturally occurring; when naturally occurring, they are considered contaminants when they exceed natural levels.

The earliest known writings concerned with pollution were Arabic medical treatises written between the 9th and 13th centuries. King Edward I of England banned the burning of sea-coal by proclamation in London in 1272, after its smoke had become a problem. Air pollution would continue to be a problem in England, especially later during the industrial revolution.

It was the industrial revolution that gave birth to environmental pollution as we know it today. The emergence of great factories and consumption of immense quantities of coal and other fossil fuels gave rise to unprecedented air pollution and the large volume of industrial chemical discharges added to the growing load of untreated human waste. Chicago and Cincinnati were the first two American cities to enact laws ensuring cleaner air in 1881. Other cities followed around the country until early in the 20th century, when the short lived Office of Air Pollution was created under the Department of the Interior. Extreme smog events were experienced by the cities of Los Angeles and Donora, Pennsylvania in the late 1940s, serving as another public reminder.

The major forms of pollution are: air pollution, water pollution, soil contamination, littering, radioactive contamination, noise pollution, Light pollution, Visual pollution, thermal pollution, Pollution can also be the consequence of a natural disaster. For example, hurricanes often involve water contamination from sewage, and petrochemical spills from ruptured boats or automobiles.

Growing evidence of local and global pollution and an increasingly informed public over time have given rise to environmentalism and the environmental movement, which generally seek to limit human impact on the environment.

***1. Answer the questions:***

1. What is pollution?
2. What forms can pollution take of?
3. What historic period gave birth to environmental pollution? Why?

4. Which American cities were the first to regulate the air pollution?

5. Are modern people getting more aware of environment pollution?

6. Is there any role of mass media in supporting the environmental movement?

***2. Match the forms of pollution with their definitions:***

| | |
|---|---|
| Air pollution | the release of chemicals by spill or underground leakage. Among the most significant contaminants are hydrocarbons, heavy metals, herbicides, pesticides and chlorinated hydrocarbons. |
| Water pollution | roadway noise, aircraft noise, industrial noise as well as high-intensity sonar. |
| Soil contamination | a small refuse or waste materials carelessly dropped, esp. in public places |
| Noise pollution | the release of chemicals and particulates into the atmosphere |
| Littering | a temperature change in natural water bodies caused by human influence, such as use of water as coolant in a power plant. |
| Light pollution | the presence of overhead power lines, motorway billboards, scarred landforms, open storage of trash or municipal solid waste. |
| Visual pollution | the release of waste products and contaminants into river drainage systems, liquid spills, wastewater discharges, eutrophication and littering. |
| Thermal pollution | light trespass, over-illumination and astronomical interference. |

## Water Pollution

***Before reading the text answer the questions:***

1.What do you know about pollution as a whole? What types of pollution do you know?

2. Are there any polluted bodies of water in your place?

3. How people in your place try to protect the environment? Have you ever taken part in the actions of such kind?

Water pollution is the contamination of water bodies such as lakes, rivers, oceans, and groundwater caused by human activities. Although natural phenomena

such as volcanoes, storms, earthquakes also cause major changes in water quality and the ecological status of water, these are not deemed to be pollution.

All water pollution affects organisms and plants that live in these water bodies and in almost all cases the effect is damaging either to individual species and populations but also to the natural biological communities. It occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful constituents.

Water pollution is a major problem in the global context. It has been suggested that it is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily. An estimated 700 million Indians have no access to a proper toilet, and 1,000 Indian children die of diarrheal sickness every day. Some 90% of China's cities suffer from some degree of water pollution, and nearly 500 million people lack access to safe drinking water. In addition to the acute problems of water pollution in developing countries, industrialized countries continue to struggle with pollution problems as well.

The governments of many countries have striven to find solutions to reduce this problem. Many pollutants threaten water supplies, but the most widespread, especially in underdeveloped countries, is the discharge of raw sewage into natural waters; this method of sewage disposal is the most common method in underdeveloped countries, but also is prevalent in quasi-developed countries such as China, India and Iran.

Sewage, sludge, garbage, and even toxic pollutants are all dumped into the water. Even if sewage is treated, problems still arise. Treated sewage forms sludge, which may be placed in landfills, spread out on land, incinerated or dumped at sea. In addition to sewage, nonpoint source pollution such as agricultural runoff is a significant source of pollution in some parts of the world, along with urban storm water runoff and chemical wastes dumped by industries and governments.

Water pollution has many causes and characteristics.

Industries discharge a variety of pollutants in their wastewater including heavy metals, organic toxins, oils, nutrients, and solids. Pollutants in water include a wide

spectrum of chemicals, pathogens, and physical chemistry or sensory changes. Many of the chemical substances are toxic.

Discharges can also have thermal effects, especially those from power stations.

***1. Answer the questions:***

1. What is water pollution?
2. Why water pollution effects the whole natural biological communities?
3. Do you think governments are able to stop dumping the sewage, sludge, garbage and toxic pollutants into the water?
4. What is the situation in India, China and other developing countries?
5. Which natural phenomena also cause major changes in water quality?

***2. Which statements are True (T) or false (F) according to the article?***

1. The governments of many countries reduce this problem of pollution.
2. If sewage is treated, problems disappear.
3. Polluted water includes a wide spectrum of chemicals and pathogens.
4. 1,000 Indian children die of diarrheal sickness every week.

***3. a) What do these numbers refer to?***

90, 700, 14,000, 90%, 1,000

**b)** ***Make out questions to which the following numbers are answers.***

## Water Pollutants

***Match the following words with Russian equivalents.***

| | |
|---|---|
| 1. contaminants | A. моющие средства |
| 2. pollutants | B. продукты гигиены |
| 3. detergents | C. загрязняющие вещества |
| 4. aquifers | D. разжижение, разбавление |
| 5. electrical conductivity | E. заражающие вещества |
| 6. hygiene products | F. всасывание, впитывание |
| 7. transform | G. водоносный пласт |

| | |
|---|---|
| 8. acidity | H. кислотность |
| 9. dilution | I. электропроводимость |
| 10. absorption | J. преобразовывать, превращать |

The specific contaminants leading to pollution in water include a wide spectrum of chemicals, pathogens, and physical or sensory changes such as elevated temperature and discoloration. While many of the chemicals and substances that are regulated may be naturally occurring (calcium, sodium, iron, manganese) the concentration is often the key in determining what is a natural component of water, and what is a contaminant.

Many of the chemical substances are toxic. Pathogens can produce waterborne diseases in either human or animal hosts. Alteration of water's physical chemistry includes acidity (change in pH), electrical conductivity, temperature, and eutrophication. Eutrophication is the fertilization of surface water by nutrients that were previously scarce.

The microorganisms sometimes found in surface waters which have caused human health problems include: salmonella, viruses and parasitic worms.

Contaminants may include organic and inorganic substances.

Organic water pollutants include: detergents, food processing waste such as fats and grease, fuels such as gasoline, diesel fuel, jet fuels, motor oil, tree and bush debris from logging operations, various chemical compounds found in personal hygiene and cosmetic products.

Inorganic water pollutants include: acidity caused by industrial discharges, chemical waste as industrial by-products, fertilizers which are found in storm water runoff from agriculture, as well as commercial and residential use.

Most water pollutants are eventually carried by rivers into the oceans. In some areas of the world the influence can be traced hundred miles from the mouth by studies using hydrology transport models. Advanced computer models have been used in many locations worldwide to examine the fate of pollutants in aquatic systems.

Many chemicals undergo reactive decay or chemically change especially over long periods of time in groundwater reservoirs. Groundwater pollution is much more difficult to abate than surface pollution because groundwater can move great distances through unseen aquifers. Non-porous aquifers such as clays partially purify water of bacteria by simple filtration (absorption), dilution, and, in some cases, chemical reactions and biological activity: however, in some cases, the pollutants merely transform to soil contaminants. Groundwater that moves through cracks and caverns is not filtered and can be transported as easily as surface water.

Water pollution may be analyzed through several broad categories of methods: physical, chemical and biological.

There are several ways to test water: physical, chemical, and biological.

Common physical tests of water include temperature, solids concentration and turbidity.

Water samples may be examined using the principles of analytical chemistry. Many published test methods are available for both organic and inorganic compounds. Frequently-used methods include pH, biochemical oxygen demand, chemical oxygen demand, nutrient, metals (including copper, zinc, cadmium, lead and mercury), oil and grease, total petroleum hydrocarbons, and pesticides.

Biological testing involves the use of plant, animal, and/or microbial indicators to monitor the health of an aquatic ecosystem.

***1. Write down the endings of the following sentences:***

1. Contaminants may include_____
2. Naturally occurring chemicals and substances are _____
3. Non-porous aquifers partially purify water of bacteria by_____
4. Groundwater can be transported _____
5. Organic water pollutants include_____
6. Alteration of water's physical chemistry includes_____

***2. Put the questions to the text. Use different types of questions.***

***3. Fill in the gaps using the words:***

*computer, pollutants, analyzed, toxic, pollution, groundwater, aquatic*

1. Most water _____are eventually carried by rivers into the oceans.

2. Many of the chemical substances are _____.

3. _____pollution is much more difficult to abate than surface _____because groundwater can move great distances through unseen aquifers.

4. Water pollution may be _____through several broad categories of methods.

5. Advanced _____ models have been used in many locations worldwide to examine the fate of pollutants in_____ systems.

***4. Tell about the differences between the physical, chemical and biological ways of testing water. Which of them is the most difficult to provide?***

## Marine Pollution

***Match the following words with their Russian equivalents:***

| | |
|---|---|
| 1. marine pollution | A. сухогруз |
| 2. residential waste | B. удушье |
| 3. invasive organisms | C. ткань |
| 4. nonpoint sources | D. загрязнение моря |
| 5. devastating effects | E. организмы-захватчики |
| 6.oil spills | F. отходы из жилых массивов |
| 7. harmful algae | G. нефтяные пятна |
| 8. suffocation | H. вредные водоросли |
| 9. tissues | I. осколки, обломки |
| 10. debris | J. опустошительный эффект |

1) Marine pollution occurs when harmful effects can result from the entry into the ocean of chemicals, particles, industrial, agricultural and residential waste, noise, or the spread of invasive organisms. Most sources of marine pollution are land based. The pollution often comes from nonpoint sources such as agricultural runoff and windblown debris.

2) There are many different ways to categorize, and examine the inputs of pollution into our marine ecosystems. Generally there are three main types of inputs

of pollution into the ocean: direct discharge of waste into the oceans, runoff into the waters due to rain, and pollutants that are released from the atmosphere.

3) Ships can pollute waterways and oceans in many ways. Oil spills can have devastating effects. While being toxic to marine life, the components in oil are very difficult to clean up, and last for years in the sediment and marine environment.
Discharge of cargo residues from bulk carriers can pollute ports, waterways and oceans. Ships create noise pollution that disturbs natural wildlife, and water from ballast tanks can spread harmful algae and other invasive species.

4) Discarded plastic bags, pack rings and other forms of plastic waste which finish up in the ocean present dangers to wildlife and fisheries. Aquatic life can be threatened through entanglement, suffocation, and ingestion. Fishing nets, usually made of plastic, can be left or lost in the ocean by fishermen. Known as ghost nets, these entangle fish, dolphins, sea turtles, sharks, dugongs, crocodiles, seabirds, crabs, and other creatures, restricting movement, causing starvation, laceration and infection, and, in those that need to return to the surface to breathe, suffocation.

5) Marine life can be susceptible to noise or sound pollution from sources such as passing ships, oil exploration seismic surveys. Sound travels more rapidly and over larger distances in the sea than in the atmosphere. Marine animals, such as cetaceans, often have weak eyesight, and live in a world largely defined by acoustic information. This applies also to many deeper sea fish, which live in a world of darkness. Between 1950 and 1975, ambient noise in the ocean increased by about ten decibels.

6) – Chinese and Russian industrial pollution such as phenols and heavy metals in the Amur River have devastated fish stocks and damaged its estuary soil.
– Wabamun Lake in Alberta, Canada, once the best whitefish lake in the area, now has unacceptable levels of heavy metals in its sediment and fish.

– Due to their high position in the food chain, mercury levels can be high in larger species such as bluefin and albacore. As a result, in March 2004 the United States issued guidelines recommending that pregnant women, nursing mothers and children limit their intake of tuna and other types of predatory fish.

– Some shellfish and crabs can survive polluted environments, accumulating heavy metals or toxins in their tissues. For example, mitten crabs have a remarkable ability to survive in highly modified aquatic habitats, including polluted waters. The farming and harvesting of such species needs careful management if they are to be used as a food.

– Mining has a poor environmental track record. For example, according to the United States Environmental Protection Agency, mining has contaminated portions of the headwaters of over 40% of watersheds in the western continental US. Much of this pollution finishes up in the sea.

– Heavy metals enter the environment through oil spills or from other natural or anthropogenic sources.

7) Marine pollution is part of the problem of too much pollution by humans in general. There are only two ways to remedy this: either the human population is reduced, or the ecological footprint left behind by the average human is reduced. If we do not follow the second way, then the first way may be imposed upon us, as world ecosystems falter and cease to support us.

The second way is for us, individually, to consume and pollute less than we do currently. For this there must be social and political will, together with a shift in awareness, so more people respect their environment and are less disposed to abuse it.

8) At an operational level, regulations, and international government participation is needed. It is often very difficult to regulate marine pollution because pollution spreads over international barriers, thus making regulations hard to create as well as enforce.

9) Perhaps the most important strategy for reducing marine pollution is education. Most are unaware of the sources, and harmful effects of marine pollution, and therefore little is done to address the situation. In order to inform the population of all the facts, in depth research must be done to provide the full scale of the situation. Then this information must be made public.

***1. Find out the titles for the paragraphs of the text:***

1. Regulation of marine pollution.
2. Specific examples.
3. Strategy for reducing marine pollution
4. Noise pollution.
5. Solutions.
6. Main types of inputs of marine pollution.
7. Sources of marine pollution.
8. Plastic debris.
9. Pollution from ships.

***2. Answer the questions:***

1. What are the most sources of marine pollution?
2. What is noise pollution? Is it dangerous for humanity too? Why?
3. Why is plastic debris so dangerous to aquatic life?
4. What is the solution of the marine pollution problem?
5. What is the most important strategy for reducing marine pollution? Why education is so important in reducing any form of pollution?

***3. Fill in the gaps with the words below****:*

*regulations, agricultural runoff, to inform, full scale, noise pollution, inputs , aquatic life*

1. The pollution often comes from nonpoint sources such as _____ and windblown debris.
2. Generally, there are three main types of _____ of pollution into the ocean.
3. Ships create _____ that disturbs natural wildlife, and water from ballast tanks can spread harmful algae and other invasive species.
4. _____can be threatened through entanglement, suffocation, and ingestion.
5._____ and international government participation is needed.
6. In order _____ the population of all the facts, in depth research must be done to provide the _____ of the situation.

## Effects of Pollution

Adverse air quality can kill many organisms including humans. Ozone pollution can cause respiratory disease, cardiovascular disease, throat inflammation, chest pain, and congestion. Water pollution causes approximately 14,000 deaths per day, mostly due to contamination of drinking water by untreated sewage in developing countries. As estimated 700 million Indians have no access to a proper toilet, and 1,000 Indian children die of diarrheal sickness every day. Nearly 500 million Chinese lack access to safe drinking water. 656,000 people die prematurely each year in China because of air pollution. In India, air pollution is believed to cause 527,700 fatalities a year. Studies have estimated that the number of people killed annually in the US could be over 50,000.

Oil spills can cause skin irritations and rashes. Noise pollution induces hearing loss, high blood pressure, stress, and sleep disturbance. Mercury has been linked to developmental deficits in children and neurologic symptoms. Older people are majorly exposed to diseases induced by air pollution. Those with heart or lung disorders are under additional risk. Children and infants are also at serious risk. Lead and other heavy metals have been shown to cause neurological problems. Chemical and radioactive substances can cause cancer and as well as birth defects.

Pollution has been found to be present widely in the environment. There are a number of effects of this:

– Sulphur dioxide and nitrogen oxides can cause acid rain which lowers the pH value of soil.

– Soil can become infertile and unsuitable for plants. This will affect other organisms in the food web.

– Smog and haze can reduce the amount of sunlight received by plants to carry out photosynthesis and leads to the production of troposphere ozone which damages plants.

– Invasive species can out compete native species and reduce biodiversity.

– The emission of greenhouse gases leads to global warming which affects ecosystems in many ways.

Carbon dioxide (CO2), while vital for photosynthesis, is sometimes referred to as pollution, because raised levels of the gas in the atmosphere are affecting the Earth's climate. Disruption of the environment can also highlight the connection between areas of pollution that would normally be classified separately, such as those of water and air.

Pollution control is a term used in environmental management. It means the control of emissions and effluents into air, water or soil. Without pollution control, the waste products from consumption, heating, agriculture, mining, manufacturing, transportation and other human activities, whether they accumulate or disperse, will degrade the environment. In the hierarchy of controls, pollution prevention and waste minimization are more desirable than pollution control.

***1. Answer the questions:***

1. What are the effects of pollution on human health?
2. What is the situation in India and China due to terrible water supply system and air pollution?
3. What are the effects of pollution on environment?
4. Which form of pollution induces hearing loss, high blood pressure, stress, and sleep disturbance?
5. Which disease can cause chemical and radioactive substances?
6. Are the areas of pollution classified separately connected between?
7. What means pollution control?

***2. Complete the sentences:***

1. Ozone pollution can cause_____.
2. 1,000 Indian children die of _____ .
3. Nearly 500 million Chinese lack access to_____ .
4. Oil spills can cause _____ .
5. Lead and other heavy metals cause_____.
6. Smog and haze can reduce the amount_____.
7. The emission of greenhouse gases leads to_____.
8. Pollution control is a term used in_____.

9. Pollution control means the_____.

10. Carbon dioxide is sometimes referred to as _____.

***3. Match the words with the definitions:***

| | |
|---|---|
| congestion | to bring notice or emphasis to |
| disperse | the act, process or industry of extracting coal, ores from the Earth |
| heating | to distribute over a wide area |
| manufacturing | the science or occupation of cultivating land; farming |
| mining | a tangible matter of which a thing consists |
| agriculture | the reaction of living tissue to injury or infection, characterized by heat, redness and pain |
| inflammation | the state of being overcrowded, overloaded |
| photosynthesis | a device or a system for supplying heat |
| highlight | the production of goods |
| substance | the synthesis of organic compounds from carbon dioxide and water using light energy |

***4. Match the heading with the paragraphs***:

1. Pollution control.

2. The effects of pollution on environment.

3. The effects of greenhouse gases and global warming.

4. The effects of pollution on human health.

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